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ABSTRACT

Prepared as part of the Asia Pacific Economic Cooperation Forum's efforts to explore issues related to economic development and technology training, the three essays in this collection describe industrial training efforts at community colleges, focusing on partnerships with the private sector, programs targeted at women, and the use of cost-benefit analyses in evaluating programs. Following a brief preface, "Private and Public Sector Partnerships in Skills Training for Industrial Technology" (Alex Curran and William Hanna) analyzes key characteristics of five public and private sector training partnerships in Canada, the United States, Singapore, Chinese Taipei, and Malaysia. Next, "Industrial Technology Training Programs for Women: Gender Issues & Program Success Factors" (Miriam Bailey) reviews reasons for improving women's participation in training and describes key characteristics of four programs designed primarily for women. Finally, "Cost-Benefit Analysis and Industrial Training: A Case for Minimizing Objectives" (Michael Hatton and John Holland), examines aircraft mechanic training programs to determine the degree to which cost-benefit analysis might be used for setting policies, strategies, and tactics in training programs. The first essay contains 14 references, the second contains 46, and the third contains 10 references. (TGI)

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TRAINING IN INDUSTRIAL TECHNOLOGY

A Collection of Essays

Edited by Michael J. Hatton

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ASIA PACIFIC ECONOMIC COOPERATION

Canadian International Development Agency

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PREFACE

Established in 1989, the Asia Pacific Economic Cooperation (APEC) Forum is a policy-oriented organization that discusses economic trade issues of interest to its members. APEC's objectives include: sustaining the economic growth of the region; enhancing gains resulting from increasing economic interdependence; developing and strengthening an open multilateral trading system; and reducing the barriers to trade in goods, services and investment among members and others.

APEC membership includes Australia, Brunei, Canada, Chile, Chinese Taipei, Hong Kong, Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, the People's Republic of China, the Philippines, Singapore, Thailand and the United States of America.

Canada, as part of its commitment to APEC, developed a book which inventoried a collection of 53 "exemplary" models of training in industrial Technology. This was published by the Association of Canadian Community Colleges (ACCC) in 1995 under the title *Exemplary Training Models in Industrial Technology*. A conference was held in May 1995 to discuss these models, and this collection of essays is designed to further explore organizational and policy issues in the field of industrial technology.

The first essay in this collection focuses on private and public sector partnerships in skills training for industrial technology. The researchers for this paper, Alex Curran and William Hanna, investigated literature pertinent to training partnerships in the 90s, and visited a variety of public/private sector training partnerships highlighted in *Exemplary Training Models in Industrial Technology*, including examples in Canada, the U.S., Singapore, Chinese Taipei and Malaysia. Their study identifies, examines and analyzes key characteristics associated with these training partnerships. The goal of the study is to better inform training partners with regard to factors that affect and drive the nature of effective public/private partnerships. During the past twenty years there has been a large increase in the number and type of training partnerships, and this study provides data that will encourage this trend.

The second essay investigates industrial technology training programs targeted specifically at women. It includes a literature review and an examination of four training programs. Based on this research, the author, Miriam Bailey, identifies a variety of indicators for program success that are recommended to government bodies and training institutions when designing industrial technology training programs specifically for women. These include close collaboration with industry, the implementation of close support systems that include financial assistance and advising, the opportunity for participants to manufacture "real" products, and a commitment to long term funding.

The third essay examines the degree to which cost-benefit analysis could (or should) be used for scrutinising training with the field of industrial technology. It does this by examining the specific case of training for aircraft mechanics. Michael Hatton and John Holland authored this paper, which includes an analysis of training models in Canada, the U.S., Hong Kong, Malaysia, Thailand and Brunei. Readers who are

interested in the relationship between freer trade and competition in the field of training will find this essay particularly interesting.

The authors are an eclectic group, and the papers reflect this. Alex Curran holds an M.Sc. from the University of Ottawa (Canada), and is well known for his expertise in the field of telecommunications and his work with Bell-Northern Research, Northern Telecomm and SED Systems. In the early 1980s he was Assistant Deputy Minister of the Department of Communications (Canada), at which time he was responsible for Canada's Space Program. William Hanna holds a D.E.A. from the Université Paul Valery (Montpellier, France) and an M.A. from the University of Chicago (U.S.A.). He is Chair of the General Education Program at Humber College in Toronto, and has developed and implemented a variety of college/industry partnership programs.

Miriam Bailey is the Director of the Canadian Vocational Association. She holds a B.Comm. from the National University of Ireland and an M.A. and a Ph.D. from McGill University (Montreal, Canada). During the past 25 years she has been a teacher, technical and vocational education consultant, college administrator, civil servant and manager of a university review in such places as Ireland, Hong Kong, the U.K. and Canada.

John Holland holds a Ph.D. in Comparative Education from Syracuse University (U.S.A.), and is a professor at the Ontario Institute for Studies in Education and the University of Toronto, where he teaches courses on public finance and the economics of education. Michael Hatton is the Association of Canadian Community College's technical representative to the Asia Pacific Economic Cooperation (APEC) Human Resource Development in Industrial Technology (HURDIT) group. He compiled and edited *Exemplary Training Models in Industrial Technology*, and holds an M.B.A. from York University (Toronto, Canada) and a Ph.D. from the University of Toronto (Canada).

Comments to the editor are encouraged.

May 20, 1995

PUBLIC/PRIVATE SECTOR PARTNERSHIPS IN SKILLS TRAINING FOR INDUSTRIAL TECHNOLOGY

by Alex Curran and William Hanna

1.0 PROJECT OVERVIEW

Public sector organizations, those that are funded primarily through government funds, and private sector organizations, those that are funded through competitive activity in an open market, both play important roles in a balanced economy. Public sector organizations are expected to deliver services or products that would not be delivered in sufficient quantity if left to the private sector. By contrast, efficiency in a competitive market is thought to be the virtue of private sector organizations.

Despite this dichotomy, there are many economic activities in which both public and private sector organizations are active. Training is but one example. At times they compete, and at other times they cooperate through a variety of partnership forms. In fact, public/private sector partnerships in the field of training and education are becoming increasingly common in many economies.

• public/private sector partnerships in the field of training and education are becoming increasingly common

This study examines and evaluates characteristics associated with the design of public/private sector training partnerships. It does this within the context of a literature review and an on-site examination of partnership models in five APEC member economies. The purpose of the study is provide an analysis which better informs training organizations and their industrial partners with regard to factors that affect and drive the nature of effective partnerships.

2.0 LITERATURE REVIEW

With the expansion of partnerships and the growing interest of governments to promote these activities, it comes as no surprise that the literature pertaining to public/private sector, training and education partnerships is plentiful. In a recent study, Bowie (1994) examined the rapid growth of private/public sector partnerships, and discussed the costs and benefits that these partnerships bring to both businesses and to institutions of higher education. He described the essential purpose of partnerships as supplying skilled workers, in the quantities required by industry, at the appropriate time. A partnership exists when: (1) a formal agreement binds two or more training institutions or a training institution and one or more companies or industrial associations; (2) the agreement is of sufficient duration that the intent is to create a lasting association, as opposed to a simple contract to deliver specific curriculum; and, (3) there is evidence of mutual participation in one or more of program management, finance, cur-

riculum definition or the provision of faculty.

In 1993, the American Association of Community Colleges (AACC) sponsored five activities designed to build and develop the capacity of community colleges to respond to the work force development needs of employers and employees through contract training services (see Falcone, 1994). Three of these activities targeted community college-based business and industry liaisons. These partnerships are claimed to: promote economic development, contribute to the renewal of faculty and professional development, improve fiscal stability, and add international dimensions to curricula (Pezzoli & McOmber, 1993). In difficult financial times, training institutions find partnerships a means for augmenting budgets, increasing course offerings, adding to faculty positions, and, in some cases, building or developing physical plants. A study of the relationship between the Dallas County Community College and Texas instruments suggests that partnerships have two very specific outcomes. They *improve* and *reinvent* the structure and delivery of a specific curriculum, and they more effectively prepare students for the work force, often citing increased *relevancy* and *flexibility* as key factors (see Wenrich, 1994). It is argued that, in the face of continuing change and increasing competition, colleges and universities must improve the relevance of their offerings, respond to criticisms of lack of flexibility and professionalism, develop an understanding of client needs, improve the quality of instruction, and make lifelong learning an integral part of their mission (Crabbe, 1990).

• partnerships improve and reinvent the structure and delivery of a specific curriculum, and they more effectively prepare students for the work force

There are many partnership benefits to industry as well, particularly in the area of Custom Training. Custom Training, as opposed to Training-for-Trade, is focused on the needs of a particular industrial or business client, as compared with the general needs of an industry or trade (Wismer, 1994). The benefits of targeted training include timely response to market forces and ensuring appropriate skills are delivered to a changing marketplace. Less obvious, but perhaps more telling, there is evidence to suggest that custom training clients exhibit faster employment growth, lower rates of employee turnover, and greater levels of investment and output per worker (see Minnesota Custom Training, 1994).

Businesses retrain or upgrade their employees in order to improve competitiveness through technology transfer and technical updating (see Skinner, 1990). For many businesses, there are concrete benefits that encourage them to out-source their training needs. These include increased increased flexibility and reduced costs. Flexibility flows from the wide variety of training options that become available and the ease with which training goals can be changed. Cost reduction results from reduced spoilage, decreased production down-time and diminished risk. Further, for small companies, the size and breadth of public training institutions provide resources that would be impossible to match with in-house training programs. Therefore, for many organizations, particularly smaller ones where training needs change quickly and dramatically, it makes economic sense to off-load training needs.

While custom training may be the most popular form of partnership, it is not the only model. Both apprenticeship and dual enrolment models have become a focus of

renewed interest. Successful labour/college apprenticeship partnerships show that collaboration flourishes when parties derive mutual benefits, collectively access external funds, stipulate roles and responsibilities, and have an active process for resolving conflicts (Cantor, 1992). Dual enrolment of apprentices in associate degree programs is a promising strategy which addresses the needs of the training institution, the needs of the industrial partner, and the employment and broader educational needs of the students. Agan (1994) describes the case of Carroll Technical Institute and Southwire Company as typical of such associations. For the students in the supervision stream, course work counts toward completion of an Applied Manufacturing Technology Diploma. Therefore, graduates acquire skills that improve their transferability within the job market, and industry develops its next generation of supervisors.

According to Pfeifer & Carlson (1993), the key to successful partnerships is a willingness to resolve conflicts based on the recognition that each of the partners possesses a distinct culture that shapes assumptions and expectations. For example, industry tends to think in months or quarters, while training institutions tend to think in semesters or years. Partners need to be aware of the culture and assumptions driving the other organization, as well as their own. Colleges offering training programs in partnership with business/industry should understand the implications associated with the fact that programs carrying academic credit enlist more college culture than do non-credit programs. Industry should be aware that the buyer/vendor relationship, with which business is accustomed, may not produce successful partnership programs with public sector training organizations. Colleges need to develop a pool of faculty who know, understand and accept an industry's culture, and who are flexible with regard to extended class hours, off-site locations, and accommodating changes in course content. Programs designed to provide fast response tend to be managed by *tight* partnership agreements, while those designed for longer term responses or continuing needs are characterized by *looser* associations.

• the key to successful partnerships is a willingness to resolve conflicts based on the recognition that each of the partners possesses a distinct culture

There are a number of characteristics found in successful partnerships. These include:

- clear and specific goals, developed cooperatively by the partners, that provide mutual benefits;
- mutual trust and respect among the partners;
- a structure that provides for shared governance and decision-making by all partners;
- a sense of shared responsibility among all partners for achieving the goals;
- a process for evaluation, with participation from all partners.[1]

1. Several articles provide a conceptual framework for categorizing the variables and elements that are used to evaluate customized training programs and for establishing accountability. For example, see Jacobs & Bragg (1994).

For training institutions, these characteristics are implemented through strong and effective administrative support, clearly written agreements, obvious and well defined shared interests, effective lines of communication, and access to funding sources not previously available (see Evaluation and Training Institute, 1993). As well, partnerships are strengthened when sharing takes place. This might include shared resources, joint program planning and provision, structured liaison, apportioned planning and development, shared delivery of training, joint bids for funding, and shared recruitment.

3.0 RESEARCH DESIGN

This research study required a clear, concise description of what is meant by the term "partnership", identification of factors likely to affect the nature and size of partnerships, and the identification and analysis of several partnership models in order to validate the premise on which the study is based.

3.1 Description of Partnerships

Partnerships may be described broadly or specifically. At one end of a continuum is the notion that a partnership is any association based on a joint interest. At the other end, a partnership has clearly defined, perhaps even contractual, attributes. The partnerships examined in this study fall between these extremes. They are based on specific joint interests, particular to the field of industrial technology, and most are broader in nature and more open to interpretation and evolution than a contract would suggest. Perhaps more important, and more valuable to this study than a simple definition of the term, is a description of the conditions that were met for a partnership to qualify for examination and evaluation in the context of this study. These conditions include:

- a formal agreement in existence between two or more training institutes, or between at least one training institute and at least one industry or business or industrial association;
- an agreement and relationship that clearly suggests an intent to forge a lasting association, as compared with a contract to deliver a specific curriculum;
- evidence of mutual involvement in one or more of overall project management and evaluation, financing, curriculum development, and the selection of faculty.

3.2 Factors Affecting Partnership Design

Key factors affecting the design of the partnership, and the ones examined in this study, include:

Purpose

The essential purpose of a partnership agreement is to supply skilled workers in quantities required by local industry at the time required. If specific skills are required by a single company, the resulting partnership will be strong and close in nature, almost resembling a contract. If the skills are relevant to an industrial sector, the partnership will be weaker, perhaps managed on behalf of the industrial partners by an industry association. If the skills are applicable to an even wide sector of the economy, the partnership will be weaker still, perhaps directed by a committee representing the sector.

Timing

Programs designed to provide fast response tend to be managed by tight partnership agreements, while those designed for longer term responses or continuing needs tend to be managed by looser associations.

Cost

A school is a relatively risk-free environment in which to acquire skills and capabilities. By contrast the cost of errors in industry can be much higher through spoilage of work in progress and through physical danger to the student and co-workers. The more costly the process of education, the more likely industry will seek partnerships with educational institutes. Further, the more costly the training facilities, the more likely these will be used by a variety of industrial clients, and, consequently, the more likely that the partnership will be looser, implemented by industry associations.

Size

Educational institutions are attracted to partnerships in order to augment budgets, increase course offerings, add to faculty positions and expand available facilities. Such expansion is exciting, pleasant, and manageable. But when a partnership flounders, contraction must occur. Educational institutions should keep individual partnerships small, tight and specific, while seeking diversity through multiple partners.

Employment

In tight partnerships the industrial partner recruits students who typically expect employment immediately upon graduation. This works well with short courses where employment needs can be accurately forecast. The risk becomes larger when courses are of a longer duration. Complications associated with longer term projections suggest that companies will tend to seek weaker partnerships, perhaps managed through industry associations, as course durations exceed, perhaps, one year.

Corporate Size

There is little perceived risk in entering into a partnership with a large, secure, long established company; there is much more perceived risk in committing the institute to a partnership with a small company with a short history. Thus, the training needs of

small companies will normally be met through partnerships with industry associations, and will not typically involve customized training.

3.3 Partnership Models

The purpose of the site visits was to examine the design factors in the context of specific partnership types. Five examples of partnership models were selected.

Type 1

A partnership involving a single educational institution and a large, well established company with the goal of providing ongoing short duration courses for new employees and for the retraining of current employees.

> **Example:** The partnership between John Deere Harvester and Black Hawk College in Moline, Illinois, U.S.A. to deliver training in manufacturing Technology.

Type 2

A partnership with more than two partners and where the courses are longer than one year in duration.

> **Example 2:** The telecommunications training partnership involving The Southern Alberta Institute of Technology (SAIT), Nova Corporation, Northern Telecom (NT) Canada Ltd., Alberta Government Telephones, and the Department of Vocational Education - Thailand.

Type 3

A partnership involving one or more educational institutions and an industry association that represents the interests of a number of small to medium-sized employers.

> **Example 3:** The partnership between the Federation of Malaysian Manufacturers, Festo (M) Private Limited and FMM Entrepreneur & Skills Development Centre, Kuala Lumpur, Malaysia, to deliver training in Low Cost Automation.

Type 4

A partnership in which a dominant theme is the reduction of overall cost and risk, including the costs of lost or impaired production and the costs associated with increased danger to students and associates.

> **Example 4:** The precision tooling and machining partnership between the Precise Engineering Institute and a variety of industrial companies in Singapore.

Type 5

A partnership with a single company or an industry association in which the facility costs are so high that a single educational institution would have to supply training for many organizations in order to justify the capital costs.

> **Example 5:** The integrated circuit fabrication training partnership between Tze-Chiang Foundation of Science and Taipei based manufacturers of integrated circuits, with linkages to universities.

The source for partnership models was the inventory of technical training programs described by Hatton (1995).

3.4 Survey Format

In each of these five examples, interviews were held with administrators from the training organizations, the industrial partners, current students and graduates. The intent was to identify the expectations of each of the parties, the factors which led to the partnership agreement, the method of organization, funding sources, the degree of satisfaction and current views or changes which would be desirable.

4.0 DATA FROM THE SITE VISITS

Following are summaries of the data from the five site visits. These visits were carried out over a period of six weeks, and involved travel to western Canada, the U.S., Malaysia, Singapore, and Chinese Taipei.

4.1.1 Black Hawk Community College (U.S.A.)

Black Hawk is a comprehensive community college offering both transfer and career programs. Its principal campus is located in Moline, Illinois. Black Hawk programming includes the first two years of baccalaureate education designed to prepare students for transfer to four-year colleges and universities; career education designed for job-training, re-training, and/or upgrading of skills to meet individual, local, state and national manpower needs; and developmental education designed to provide remedial instruction, special education, adult basic education, and college preparation. The content of degree courses and programs is approved and accredited by the Illinois Community College Board and the Illinois State Board of Education.

Funding is provided primarily from tuition fees and state grants. Local industry provides grants of money and donated equipment on occasion, usually in support of particular program offerings or of capital expansion initiatives.

The community served by the Moline campus is the Quad-Cities area of Illinois and Iowa. Until about 1980 the region prospered economically as the centre of heavy

manufacturing. However, from the early 1980's industry has experienced a prolonged down-turn resulting in staff reductions, plant closures and corporate amalgamations. As one consequence of this sectoral "recession" there has been no replenishment of the work force for some 15 years. In the near future, industry will face disruption created by the retirement of a large percentage of its employees.

John Deere is a successful international supplier of agricultural machine. Recently, management began to examine the employment needs of the company, balancing the economic outlook, the aging work force and changes in technology which have influenced job functions. Traditionally, work in the company plants had been defined by specialization, leading to union agreements which identified the classes of work attributable to each specialist classification. That form of labour organization is threatened by two forces. One is a redefinition of core work, i.e., that which must be done within the company as compared to that which can be sub-contracted to suppliers. The second is the impact of changes in manufacturing technology leading to much greater dependence on flexible computer controlled and robotic machines. These forces have created the need for a more flexible organization of work and labour classifications.

That challenge was addressed jointly by management and union leaders. The conclusion was that in future work must be organized, not through the subdivision of tasks to rigidly defined specialities, but rather through the creation of teams of knowledgeable generalists able to take responsibility for the successful completion of business functions. However, both management and union leaders recognized that this change could not be accomplished without significant re-education of the work force. Some of that retraining could be done effectively within John Deere, while some would be better delivered via an external training organization. Black Hawk College was selected for this role.

• work must be organized, not through the subdivision of tasks to rigidly defined specialities, but rather through the creation of teams of knowledgeable generalists able to take responsibility for the successful completion of business functions

4.1.2 The Partnership

Cooperation between Black Hawk and John Deere has a long history. On an informal basis, the relationship began in the late 1960's. Over the years, special courses had been devised to meet the needs of the company - some were offered on campus, while others were delivered on company premises. By 1990 the parties were well known to each other. It was natural, therefore, for John Deere to approach the College to find a solution to its re-training requirements.

The first area to be re-designed was the Product Engineering Department, retitled in the more flexible structure as the New Product Facility. Within this department there were 21 different job classifications, all related to the constrained work definition of product engineering. With the broader responsibility of all aspects of new product design, product introduction, procurement, etc., the 21 job classifications were reduced to just one. Within that classification the pay steps were tied to educational achievement. These changes could only be implemented, however, if a suitable training program could be devised and approved. John Deere wanted the training to broad-

en the technical base of its employees, to make them much more aware of the business element of their work, and to hone their interpersonal skills to enable them to work productively in teams. In addition there was strong support for a program that would lead to a two-year degree at the level of Associate in Applied Science so that employees would be encouraged to later pursue a four-year baccalaureate degree.

Black Hawk College responded with a proposal which drew from existing course offerings in electrical and mechanical technology. Included within the program are courses in interpersonal communications, business communication skills and work place psychology. Since the proposal followed the pattern of already approved degree offerings, and since each course within the program was already in existence, the College was able to get accreditation approval quickly.

The Black Hawk proposal won the support of both John Deere and of the Union. It was agreed that all existing, eligible employees within the department would take the program, and successful completion of the degree was a requirement for all new hires.

4.1.3 Progress

The first course was offered in 1992, and the first two graduates completed the program in late 1994. Current enrolment is approximately 20 students, of whom two are from outside John Deere. Both College and company representatives seem satisfied that this level of enrolment is acceptable. However an analysis of the program suggests that enrolment numbers should be higher if the full retraining objective is to be met.

Management at John Deere is not concerned, as yet, about the discrepancy between enrolment and training needs. Overall qualitative results to date are better than anticipated with respect to improving the abilities of the employees, and management is exploring expanded degree offerings in manufacturing courses.

4.1.4 Form of Partnership

There is no formal agreement between John Deere and Black Hawk College. The relationship is based on a handshake, and committee structures are very informal. However, contact between managers at John Deere and faculty members is regular and effective.

John Deere does not contribute money directly to the program, other than contributions to student tuition fees. Those fees plus grants from the State of Illinois provide Black Hawk with approximately $78 (U.S.) per student credit hour.

This cooperative project would be classified as a weak association. The commitment is in the form of a handshake, the Company has made no monetary commitment to the College, and there are no formal cross-management committees. Both parties are free to withdraw from the partnership at any time. As currently implemented, the training is directed at teaching broad, technical skills. As a result, there is potential for participation by other companies. At this stage the emphasis is on retraining current

Deere employees; However, within a few years that will shift as the company requires more new employees.

The project has limited impact upon the College. Enrolment in the program is small, and the courses are drawn from the existing inventory. In a real sense, the College is simply making better use of its existing product line.

• enrolment in the program is small, and the courses are drawn from the existing inventory; the College is simply making better use of its existing product line

4.1.5 Comments

This partnership is an interesting example of cooperation in times of great change. John Deere has been a rigid hierarchical company where job functions are tightly defined, union and management are antagonists, and business is strictly the domain of management. This is no longer true. Now, employee teams are replacing hierarchies, business decisions are made by teams, and traditional production machines are being replaced by computer controlled machines and multi-purpose robots. In this changing environment employees must have a much broader knowledge base. There is a great deal of re-training taking place at John Deere, accepted by the company and union as a joint responsibility.

• employee teams are replacing hierarchies, business decisions are made by teams, and traditional production machines are being replaced by computer controlled machines and multi-purpose robots

4.2.1 Southern Alberta Institute of Technology (Canada)

The Southern Alberta Institute of Technology (SAIT), founded in 1916, is Canada's oldest polytechnic college. It offers two year diploma programs in 37 disciplines, certificate level programs (up to one year duration) in an additional fourteen disciplines, and apprenticeship training in association with employers in 25 trades. No degree level courses are offered. There are, however, plans to deliver a limited range of baccalaureate programs within the next few years.

All training is directed to the employment needs of industry. Current full-time enrolment is 7,000 students in diploma and certificate courses, and 3,900 in apprenticeship training. In addition some 42,000 students are enroled in part time and continuing education programs. In 1993, 93% of the graduates secured employment, 81% in jobs directly related to the training undertaken at SAIT.

Industry is heavily involved in the operations of SAIT through management oversight committees at the institution, department and program levels. SAIT encourages faculty members to spend time in industry and recruits industry personnel to deliver specific courses. In 1994 SAIT's budget was Cdn.$84 million: 76% from government grants, 17% from industrial contributions and 6% from student tuition fees.

This study focused on SAIT's telecommunications training partnership with the Department of Vocational Education (DOVE), Thailand, as well as the telecommunications training that SAIT provides in partnership with Northern Telecom (NT).

4.2.2 Partners

Alberta Government Telephones (AGT) is a public company that provides telecommunications facilities and services to all of the province save the city of Edmonton. AGT has been actively involved with SAIT since the inception of its telecommunications training department in 1967, and more recently has worked with SAIT as a partner on the Dove Project. Until 1982, SAIT and its sister institute, the Northern Alberta Institute of Technology (NAIT), supplied all telecommunications apprenticeship training on behalf of AGT. Thereafter, hiring freezes at AGT reduced intake demand so drastically that NAIT alone now conducts telecommunications apprenticeship training in Alberta. The DOVE Project has provided developmental experience for AGT employees, and excellent opportunities for AGT to evaluate business prospects for its international arm.

Nova Corporation is a Calgary based company that is active in the field of recovery and distribution of natural gas. This involves the construction and operation of very large pipeline networks. In turn, these pipelines are supervised, monitored and controlled through a private dedicated telecommunications network, the third largest telecommunications network in the province of Alberta. Nova joined the DOVE project in 1993.

Northern Telecom is the largest Canadian supplier of telecommunications equipment and a highly successful multi-national corporation. Within Calgary, Northern employs about 2,500 persons, most of whom are involved in the design, manufacture, sale and servicing of wireless telecommunications systems. Northern is not a partner in the DOVE project. However, SAIT and Northern cooperate on diploma courses in electronics manufacturing, and Northern has contracted with SAIT to provide telecommunications courses on Meridian equipment.

4.2.3 The DOVE Project

The DOVE-SAIT Telecommunications Linkage Project (DOVE Project) developed from the recognition that telecommunications is a rapidly developing growth industry in southeast Asia, and that development funding from international funding agencies is available to support related training. There is a shortage of qualified telecommunications technologists in southeast Asia, and Thailand is particularly constrained by that shortage. SAIT has an impressive reputation in the telecommunications training field, having worked closely with the Canadian telecommunications industry for several decades.

SAIT attracted AGT and NOVA as industrial partners to the DOVE project. AGT was able to provide qualified people for temporary service in Thailand, and Nova Corporation has excellent experience in the design and operation of private telecom networks, particularly those which incorporate facilities for automated supervisory and control systems. Further, Nova Corporation already had consulting teams operating in Asia. The Canadian International Development Agency (CIDA) provided

$1.4M (Cdn.) and the Department of Vocational Education in Thailand provided $.4M (Cdn.) in support of this training initiative.

The goal of the DOVE project is to establish five regional telecommunications centres with the capacity to produce 200 graduates per year acceptable to Thai telecommunications industry standards. The first graduates should enter the work force in 1998.

This is a tightly controlled project with clear objectives, a defined budget, and established timelines. While the DOVE Project is an interesting, challenging and useful project, it is small (20 trainees in a total training cadre of 600) in comparison to SAIT's ongoing telecommunications activities and also small in comparison to the ongoing business operations of the industrial partners.

4.2.4.0 SAIT - Northern Telecom Partnership

In the early years of SAIT's involvement in telecommunications technology training, the primary client was AGT. In one year AGT absorbed the entire class of 780 graduates from the combined SAIT/NAIT telecommunications apprenticeship program. Since 1982, however, hiring freezes, productivity improvements and related issues have drastically reduced the hiring needs at AGT.

Fortuitously for SAIT, as AGT's demand for graduates declined, Northern Telecom expanded its work force in Calgary and became a major employer of diploma level graduates. Also, in the early 1990s Northern needed to expand its facilities for customer and technician training on the Meridian 1 PBX product line. Until that time all Canadian Meridian customer training was presented at Northern's plant in Belleville, Ontario. (Subsequently, this training facility was moved to the Bramalea plant.) Northern felt that it would be more convenient for customers if some of the courses were offered in Western Canada. Because of SAIT's reputation and industrial involvement, Northern invited SAIT to provide Meridian training for the western region.

4.2.4.1 Meridian 1 Training

This is a strong contract driven relationship. Northern Telecom defines the courses to be offered, specifies the curriculum to be used, and qualifies the instructors. Northern publicizes the courses, provides all registration services and collects all the tuition fees. In addition Northern supplies all equipment.

For its part SAIT has dedicated two classrooms to the program and two instructors who have been qualified by Northern. In return SAIT receives reimbursement for all direct costs of operation plus 30% to compensate for overhead costs. In addition, and perhaps most importantly, SAIT uses the NT equipment for its regular diploma level program offerings.

Both parties have expressed satisfaction with the strong contractual nature of the partnership. Northern is pleased to have the western training centre available for the

convenience of its customers, and it prefers to out source the training function. SAIT was selected as the training supplier because of its location, reputation and the comfort level engendered by years of association with NT. The relationship provides SAIT with the opportunity to upgrade faculty, access state-of-the-art equipment, and bring in additional revenue.

4.2.4.2 Industrial Manufacturing Technology

For some years SAIT provided NT with specialized courses to improve technical skills (eg. soldering) and strengthen basic knowledge in such fields as mathematics and technical aspects of telecommunications. By the late 1980s Northern had concluded that a more formal offering was needed which would encourage employees to upgrade skills in a diploma level program. As a result, and at the request of NT, SAIT developed a Manufacturing Technology Program. This program is structured in four blocks, each in the range of 450-500 instructional hours or the equivalent of one term of full-time attendance. SAIT awards a technician certificate at the end of block 2 and a technologist diploma upon completion of block 4.

The program was first offered in 1992, with most courses scheduled for nights and weekends. More than 90 students are currently enroled. Four students were interviewed as part of this study, and all expressed satisfaction with the content and quality of the learning experience and its relevance to their work. In addition, all felt that the program opened opportunities for advancement within Northern that would otherwise have been closed to them. They did express concern that the time to completion for full-time employees is in the range of 10 - 12 years.

4.2.5 Comments

SAIT is responding to rapid changes in the market it serves. It would have been easy for SAIT to accept the inevitable winding down of the apprenticeship programs and, perhaps, the gradual disappearance of the telecommunications training department. Instead SAIT identified new training opportunities in the field of manufacturing technology and developed the necessary partnerships to ensure successful programming.

It will be interesting to observe the evolution of manufacturing technology and similar programs. Because it takes 10 - 12 years to complete programming of this type, it is tantamount to continuous updating.

• ***because it takes 10 - 12 years to complete programming of this type, it is tantamount to continuous updating***

4.3.0 Federation of Malaysian Manufacturers (Malaysia)

The Federation of Malaysian Manufacturers (FMM) is an association of 1700 manufacturing companies. Its members employ approximately 30% of the total Malaysian work force. In general, FMM's purpose is to ensure that there is a legislative climate which encourages growth in the manufacturing sector, and to work with member com-

panies to improve their productivity and safety records.

FMM has established an Entrepreneur and Skills Development Centre (ESDC). The purpose of the ESDC is to provide skills and knowledge updating courses and seminars. Some of these are developed in-house while others are purchased from training suppliers.

4.3.1 Festo Didactic

Festo Sdn. Berhad is the Malaysian subsidiary of a German multi-national firm, active in Malaysia since 1979. Its primary product line is industrial automation systems applied to manufacturing processes. However, a subsidiary operating under the name of Festo Didactic performs R&D on the educational process, designs courses suitable for industrial customers, and produces the appropriate curricula, presentation material, text books and training equipment. Course materials are available in the fields of industrial automation and communications.

In 1979 Festo signed a Memorandum of Understanding with FMM ESDC for cooperation in the provision of low cost automation training programs. Under the terms of the Memorandum of Understanding, Festo agreed to customize its automation programs for presentation in Malaysia. FMM publicizes the availability of courses, manages course registrations, and assists companies in applying for state grants to reduce training costs.

4.3.2 Regulatory Issues

There is a severe shortage of skilled labour in Malaysia. For many years industry had been attracted to the country by the lure of low wages. However, Malaysia is no longer a low labour cost haven within southeast Asia. To maintain its competitive position, it must upgrade work force skills.

Until 1993, government supported technical institutes only offered full-time, long duration (one year or more) programs. As a result, government institutes did not address the challenge of improving the skills of the existing labour force . In 1993 this changed, but only to the extent that government institutes now offer short courses on holidays and weekends. The training impact will be limited until the need for upgrading of skills becomes more widely accepted.

Also in 1993, the Government of Malaysia established its Human Resource Development Fund (HRDF). Employers with more than 50 employees in the manufacturing sector must contribute 1% of total payroll costs to the fund. Firms which have contributed to the fund for at least six months may withdraw against their contributions to cover up to 80% of the costs of approved training programs. The Festo automation courses qualify for the maximum level of support. Nevertheless, enrolment figures show that Malaysian subsidiaries of multi-national companies are much more receptive to and supportive of work force training than are locally owned firms.

There is an apparent reluctance on the part of locally owned companies and their employees to accept ongoing skills training as a necessary part of work force development. It was further reported that training is the most vulnerable line item in corporate budgets, and that local employers fear that employees trained at their expense will leave to join a competitor's work force.

4.3.3 Low Cost Automation Program

A total of 12, three-day courses are offered under this program. Together they cover the fundamentals of pneumatic, electro-pneumatic and hydraulic control systems, programmable logic controllers, and the design and operation of such systems. Most course offerings are at the introductory level. Classes range in size from 12 to 20 students.

Illiteracy in the work force continues to be a challenge. To cope with this, special attention is given to concept reinforcement. As an example, control systems are described by the instructor, demonstrated with appropriate symbols on whiteboards, examined in cutaway form, re-examined via an overhead projector, demonstrated through video recordings, and constructed by students on specially prepared modules. To aid retention, students are provided with textbooks that contain basic information, technical descriptions, sample practical problems and descriptive solutions. The texts are also available for independent self study.

• illiteracy in the work force continues to be a challenge

4.3.4 Comments

The relationship between FMM and Festo is governed by a Memorandum of Understanding. While not so strong as a contract, the partners are clearly committed to the relationship given the size of the membership and range of activities. This would be defined as a strong association for specific skills training on a small scale with relatively low costs.

What is not evident in this type of training is a longer commitment to skills development, such as that seen in the Black Hawk-John Deere and SAIT-NT programs. In these programs the part-time training commitment may be as much as ten years. Longer term retraining is likely to be one of the next steps in the development of work force upgrading in Malaysia.

• longer term retraining is likely to be one of the next steps in the development of work force upgrading in Malaysia

4.4.0 The Precision Engineering Institute (Singapore)

The Precision Engineering Institute (PEI) is one of eleven training institutes operating under the auspices of the Institute of Technical Education (ITE). The mission of ITE is to maximize the human potential of Singapore through excellence in technical education and training, so as to develop the quality of the work force and enhance its global competitiveness. Established as a post-secondary institution in 1992, the ITE is the

national agency responsible for vocational and technical training in Singapore. In addition, ITE establishes trades accreditation standards and approves institute curricula.

The predecessor of PEI was established in 1972 as an initiative of Singapore's Economic Development Board (EDB), in partnership with Tata Engineering and Locomotive Company of India. The following year a second initiative emerged through a partnership between EDB and the Rollei Corporation of Germany. In 1984 the industrial side of this partnership was assumed by Brown Boveri. A third cooperative trades training initiative emerged in 1975 with Philips of the Netherlands as the participating industrialist. In 1988 PEI was created through the amalgamation of the Tata and Brown Boveri centres, and in 1993 overall management responsibility was transferred from EDB to ITE. The Philips centre is now also administered by PEI.

4.4.1 The Training

PEI's training goal is to provide an adequate supply of skilled precision engineering trades people to Singaporean industry. The basic training model was adapted from the German model for craft training. However, in Singapore it was not feasible to adopt the German system of apprenticeship within an industry. Instead, PEI provides apprenticeship training by simulating the work environment in a "training factory". Also, transnational partnerships form the basis whereby the training factory is equipped with state-of-the-art production equipment.

Four levels of training are provided:

- *National Trades Certificate Level 2 (NTC 2).* This is the skilled level of trade certification equivalent to journeyman standard..
- *National Trades Certificate Level 1 (NTC 1).* This is a one-year master craftsman training course reserved for NTC 2 graduates with at least three further years of industrial experience.
- *Industrial Technician Certificate (ITC).* This is a two-year technician course which delivers more theory and less practical work than NTC 2. It puts more stress on CNC and CAD/CAM technologies and on precision tooling design. The ITC graduate is intended to function as an engineering technologist.
- *Short courses of 30 - 40 hours each.* These are conducted in the evenings and occasionally on weekends. They are intended to upgrade the skills of employed trades people.

In addition PEI prepares and conducts courses tailored to the needs of individual companies. These are offered on a cost recovery basis.

4.4.2 The Training Factory

The goal of the training factory is to simulate the industrial workplace. Students clock in and out each day, and the training schedule is 44 hours per week, 50 weeks per year, just as it would be for a job in industry.

• the training schedule is 44 hours per week, 50 weeks per year, just as it would be for a job in industry

To make the instruction even more realistic, faculty members are required to seek machining jobs from industry. As the students progress, they are assigned to teams which are responsible for completing machining jobs. This exposes them to real projects with all the pressures of delivery schedules, quality standards and performance requirements. To avoid allegations of unfair competition with commercial enterprises, PEI charges competitive prices for products built in the training factory. The products as delivered are of a quality at least equivalent to commercial practice; however, delivery schedules tend to be longer.

4.4.3 Industrial Partnerships

• PEI actively seeks the best machine tool suppliers and encourages them to provide on loan to the Institute their most modern equipment

PEI actively seeks the best machine tool suppliers and encourages them to provide on loan to the Institute their most modern equipment. For PEI the advantages include: students learn on the most modern machines; faculty members are kept current through exposure to the latest equipment; and budget constraints are reduced since much of the capital equipment is donated by industry. Advantages to industry include: PEI provides a demonstration site where potential purchasers can see the machines in operation and obtain outside advice on performance; PEI will offer training for the partner's Singapore sales force; graduates of PEI leave the Institute with detailed knowledge of specific equipment which might well influence subsequent purchasing decisions.

The current list of industrial partners includes: Mitutoyo Asia Pacific Private Ltd., Saello Japan, Bridgeport Machines Ltd., Siemens Nixdorf Computer, Sodick Singapore Pte. Ltd., Auto Desk Inc, Nissei Plastics Singapore Pte. Ltd., Charmilles Technologies, Matsuura Machinery Cooperation, and Straessle Informationssysteme. In each case, ownership of the equipment remains with the supplier. The responsibilities of the two parties are defined in a Memorandum of Understanding which commits the supplier to maintain the equipment at the state of commercial art, and to give at least six months notice of intent to withdraw.

4.4.4 Enrolment & Output

• young people in Singapore exhibit a preference for careers in offices or in the electronics technologies rather than in the trades such as precision engineering

Attrition from these training programs is quite low, and as a result full-time enrolment at PEI can reach almost 800 students. However, there are problems in achieving the desired student quota. This is mainly attributed to the expansion of the Polytechnic system and the tight labour market, which have reduced the pool of applicants available for technical training at ITE. Also, young people in Singapore exhibit a preference for careers in offices or in the electronics technologies rather than in the trades such as precision engineering. Currently student enrolment shortfalls are compensat-

ed through the recruitment of Malaysians, who now constitute about 20% of the student body. PEI is free to accept students from other countries.

PEI's Advisory Board views this issue as quite serious. Industry, with its urgent need for precision engineering trades people, wants a bigger flow from PEI and they want the graduates to have higher level skills. In addition to the training at PEI a further 6-9 years of industrial experience is needed to reach the level of master craftsperson. Obviously, better skills upon graduation would reduce that period and increase productivity. However, the training time required to develop higher level skills cannot be taken from the current curriculum's stress on basic bench skills and conventional milling, turning and grinding, for these are necessary to give students a deep-seated feel for their trade, and, in any event, in spite of the proliferation of CNC machines, much of the work in industry is still performed on conventional machines. Nor can hours be added to the current timetable. Already, recruitment for the precision engineering programs courses is difficult, and to overcome that problem consideration may be given to decreasing the student workload which currently stands at 44 hours per week, 50 weeks per year.

It might seem that, if PEI cannot find resolve this dilemma, industry might be forced to assume some of the training load. However, at least one industry member of the Advisory Board argues that on-the-job apprenticeship always suffers from short term pressures of industry so that training is sacrificed to the urgent needs of job schedules. That type of problem will mitigate against any migration of training from PEI to industry. In the short term, this executive believes that skilled technical personnel needs will be met by continuing to import workers from other countries. However, these immigrants stay in Singapore only for an average of three to four years, not enough to time to yield a satisfactory economic return on the training investment. A longer term "made in Singapore" solution is still being sought.

4.4.5 Partners

Mitutoyo, the first of the industrial partners, installed a Mitutoyo Metrology Laboratory at PEI in 1987. Mitutoyo did this in order to have a showpiece in Singapore for its precision test equipment. Under the terms of the Memorandum of Understanding, the company has provided the necessary equipment and provided a three month training program in Japan for three PEI instructors. In return, PEI incorporates the equipment in its instructional program and provides tailored courses as requested by Mitutoyo. The company is very pleased that hundreds of trades people have been trained on Mitutoyo equipment, their sales force in Singapore receives excellent training, that the showpiece laboratory is available for potential customers in Singapore to view, and that potential customers from neighbouring countries are welcome to attend demonstrations and customized courses.

Representatives of two major employers of PEI graduates were interviewed for this study. Both expressed strong loyalty to PEI and support for its operational philos-

ophy. Both also commented on the difficulty of attracting young Singaporeans to the tool making trades. They agreed that, in the short run, there was no choice but to augment local recruiting with skilled foreigners.

• in the short run there was no choice but to augment local recruiting with skilled foreigners

A representative from a locally owned fabricator of tool sets was interviewed. The company was formed by two PEI graduates, operates in Singapore and in Jakarta, and regularly uses PEI's training factory to produce tool sets. Company management recognizes that there is greater risk in ordering tool sets from the training factory than there would be with internal fabrication, partly because delivery times are longer and partly because in a training environment more mistakes are made. However, the risks are weighted against a price that is about 25% less than the fully loaded internal costs of production. For this reason PEI is viewed by this and other companies as an appropriate supplier.

4.4.6 Future Developments

Throughout its 23 year history there has been continual change at PEI - in organization, in management, in location, and in partnerships. Today the most pressing problem is the difficulty attracting talented Singaporeans to enter a precision engineering career path. The solution to that challenge will involve changes in schedules and curriculum.

Management at PEI expects future changes to include a reduction in the student work week to about 35 hours, the introduction of a vacation period, the introduction of a sports and games program to provide recreation and physical development, and curriculum changes to cope with the reduction in training hours and the introduction of newer technologies such as courses in basic electronics and basic control techniques. In the face of changes, PEI management believes that two core concepts will survive: the training factory and the transnational partnerships.

• management believes that two core concepts will survive: the training factory and the trans-national partnerships

4.4.7 Comments

The Precision Engineering Institute has three types of industrial partnerships. First are the transnational partnerships. These are long term relationships which strongly influence the programs and faculty development. Each transnational partnership is governed by a Memorandum of Understanding which clearly defines the expectations and responsibilities of the parties, and which also dictates the minimum transition schedules should either party wish to terminate the partnership.

The second type of partnership is with the companies that employ the graduates. This is a looser association, but much more direct than is the case with broad brush two and three year technical training programs. The reasons for the closeness of the relationship, relative to other programming at other institutions, is the size and structure of Singapore, the narrow focus of the training, and the very strong commitment to employer/training institution relationships. The primary concern of the employers is an adequate stream of well trained trades people. The formal communications link

is the Advisory Committee structure, where the current concerns of recruitment and curriculum are being addressed.

The third partnership is with the training factory customers. The relationship is precise, and is based on the design, fabrication and delivery of machined products at an agreed time and at an agreed price. This is the crux of the training factory concept. It is a standard commercial transaction, governed by a contract and a purchase order.

At PEI the spark of genius has been to productively wed the three types of partnerships.

4.5.0 Tze-Chiang Foundation of Science & Technology (Chinese Taipei)

Tze-Chiang Foundation of Science & Technology (TCFST) is a non-profit organization founded in 1973 by alumni of National Tsing Hua University (NTHU). Its primary purpose is to foster cooperation between academic, industrial and government organizations in order to further economic and industrial development of Chinese Taipei. Currently, TCFST oversees six laboratories which are owned and jointly operated with NTHU. Those laboratories provide training and research in semiconductors, optoelectronics, integrated computer engineering, composite materials, specialty chemicals, and environmental protection. Each of these labs develops and delivers professional training programs for engineers in industry, and fosters joint research with industry and government. All labs are located on the NTHU campus, close to the Hsin-Chu scientific industrial park.

4.5.1 Semiconductor Laboratory

The semiconductor program was launched in 1985 with funding allocated by the government. The grant was consistent with a decision to foster the development of semiconductor fabrication as an industrial development strategy. With the grant, TCFST established a semiconductor processing laboratory. It has been augmented through the years with equipment donated by industry and purchases through academic research grants awarded to NTHU. Currently the laboratory is housed in a class 100 clean room facility, where four-inch wafers can be processed to a resolution of 0.8 microns. The facilities include lithography, diffusion furnaces, plasma etching, plasma doping, aluminization, and metallization with aluminum, silver and copper. The lab is used primarily for research and training, although it has the capacity for occasional use as a pilot run facility for proposed integrated circuit products.

Also in 1985, TCFST began offering courses in support of the emerging Hsin-Chu scientific industrial park. Formal courses are offered as evening classes of 30 hours delivered over ten weeks in each of three terms per year. The course fee for each participant is NT$5,000 (about US$200), which is often reimbursed by the employer. On completion of each course, the student receives a certificate which is frequently rec-

ognized by employers in the form of a salary increases. The total annual enrolment in the course offerings is about 1,500.

The courses are typically delivered by NTHU faculty members, and the content is determined through discussions with industry. Each new course offering is tested on one class of students, then modified if necessary. In addition to these formal courses, TCFST arranges short courses, workshops, seminars and conferences on the most recent developments in IC design, solid state physics and semiconductor processing.

4.5.2 Relationships With Government & Industry

The demand for new engineers is increasing, as is the demand for continuous technical upgrading of the current pool of engineers. At the same time there is pressure from industry for TCFST to train operating and maintenance personnel. This is a new challenge for TCFST. The present processing laboratory is adequate for technical training and IC experimentation; however, the training of operators and maintenance people requires exposure to equipment more closely aligned to that used in industry. Since Taiwan's industry is moving to the use of 8" wafers with sub-micron resolution and class 1 clean rooms, the cost to TCFST of matching facilities would be very high.

Some elements of the relationship between TCFST and industry are covered by a Memorandum of Understanding, but in general the relationship is informal. Each partner recognizes the value of cooperation, and each acknowledges the interdependent nature of the programming. If TCFST undertakes the training of operations people, it will be exposed to much higher capital and operating costs. At that stage a more formal agreement would be desirable.

As noted earlier, the Government identified semiconductor fabrication as an industrial development strategy. It further recognized that TCFST was an agency through which the necessary human resource skills could be developed. As a result, the Government funded the creation of the semiconductor laboratory within the Foundation, and industry provided additional support in the form of donated equipment. The Government initially funded 100% of the semiconductor training at TCFST. Now the Government pays 50% of the training costs while companies and students pay the remainder. A formal agreement exists between the Industries Development Bureau of the Ministry of Economic Affairs and TCFST. Through this agreement budgets are approved and grants awarded.

As the industry has developed, the Ministry has fostered the emergence of additional skills training sources. The National Chotung University has received funding for IC related training for the past four years and ERSO for the past three years. Both activities are small in relation to those at TCFST. Their emergence, however, seems to be a part of a national policy to develop new sources for skills training.

4.5.3 Intellectual Property

• faculty members see their reward as personal recognition by their peers

In some countries (eg., Canada and the USA), difficulties have been encountered with respect to the ownership and exploitation of intellectual property rights acquired by faculty members while pursuing research activities. That does not seem to be the case in Chinese Taipei. There, faculty members see their reward as personal recognition by their peers. Faculty salaries are standardized, and it is rare for faculty members to have additional sources of income.

4.5.4 Comments

The key factors which have led to the success of the semiconductor laboratory and teaching initiatives at Tze-Chiang Foundation of Science and Technology include: strong government support; locating TCFST on the university campus and the full cooperation of NTHU; industry recognition of the value of TCFST, the provision of equipment and, more recently, funding via tuition fees; controlling the ownership of intellectual property rights.

It is worth emphasizing that in this partnership model the government has been a key player, exerting much more influence and support than is the case with the first four models. The Memoranda of Understanding with industry are loose and non-binding, indicating a weak relationship. However, there is a formal training agreement with the Development Bureau of the Ministry of Economics. This agreement functions as a contract and provides significant up-front money for the acquisition of leading-edge equipment. As a result, this model is an example of a highly directed (ie., strong) relationship.

The major challenge for TCFST is the task of developing a plan to respond to industry's need for skills training in the operations and maintenance fields. It will be interesting to see how this challenge is addressed.

5.0 CONCLUDING REMARKS

Several key questions from the literature review were posed at the beginning of this study.

- do public/private sector training partnerships improve and help reinvent the structure and delivery of training curriculum?
- do public/private sector training partnerships actively promote economic development?
- do public/private sector training partnerships contribute to faculty renewal?
- do public/private sector training partnerships add to faculty positions?
- do public/private sector training partnerships improve fiscal stability for training organizations?

- do public/private sector training partnerships help develop capital facilities for training organizations?

From the evidence gathered in this examination of five APEC-based public/private sector training partnerships, partnerships which ranged greatly in size, scope and type of arrangement, the answer is an unequivocal yes. For example, in terms of reinventing the structure and delivery of curriculum, the SAIT-NT Meridian partnership is a strong example of the private sector partner clearly shaping the nature and style of the curriculum and its delivery, with support from a very willing public sector partner. With regard to promoting economic development, Singapore's Precision Engineering Institute is an excellent example of highly specific, targeted training, carried out in partnership with equipment manufacturers, employers and machine part buyers, that has helped propel Singapore into a position as a regional (and perhaps global) centre of excellence in this field. On an even grander scale, the Tze-Chiang Foundation of Science & Technology, in partnership with the government, universities, industry and a science park, has had an enormous economic impact on Chinese Taipei through the growth of its semiconductor industry. It's worth noting that the extreme examples are not cases of serendipity; more often they are instances of tactics falling out from an industrial development plan, constructed and supported by governments.

In almost all public/private sector partnerships, there appear to be strong opportunities for faculty renewal. In Singapore, PEI's faculty have an opportunity to work with state-of-the-art precision tool equipment, only because of the transnational partnerships that have been established. Similarly, SAIT's faculty and students are exposed to NT's lab equipment, only because of the existence of the partnership arrangement. In addition, NT provides upgrading for faculty who are delivering training on the Meridian equipment. These partnerships create additional need for faculty, many of whom come out of industry on either a full-time or part-time basis.

• in almost all public/private sector partnerships, there appear to be strong opportunities for faculty renewal

Public/private sector training partnerships help improve fiscal stability for training organizations; however, care must be taken to ensure that an individual partnership initiative does not dominate funding and that there are adequate commitments in terms of financial resources and duration. At SAIT the telecommunications program became very dependent on AGT, but the program was placed in jeopardy when AGT needs changed. Fortunately, a newer and stronger program emerged. At TCFST the training program initially serviced a small industrial client base, and funding was provided through government support. Later, as the client base developed, the financing shifted from government to industry.

Clearly, public/private sector training partnerships can be immensely helpful in terms of developing capital facilities at training institutions. This is nicely illustrated by the SAIT, FMM and the Tze-Chiang Foundation examples. Singapore's PEI has taken this to the extreme by ensuring that the multiple objectives of equipment suppliers are met directly through the loan of equipment to PEI. This fact highlights the need for training organizations to understand how to bring value added to the partner-

• public/private sector training partnerships can be immensely helpful in terms of developing capital facilities at training institutions

ship, something that the Singapore's PEI has clearly mastered.

This study also demonstrated a strong relationship between the partnership design and factors such as purpose, timing, cost, size, employment, and corporate size. Earlier in this paper it was posited that, where specific skills are required by one industrial organization, the partnership will be strong and close in nature. By comparison, where the skills are sectoral or broader in nature, the partnership will be more fluid and informal. SAIT's Meridian training is an example of the former. The training comes right from NT manuals, and the instructors are trained by NT. At the other end of the spectrum, Black Hawk's program with John Deere is very general in nature, and the relatively informal, open-ended nature of the partnership relationship reflects this.

Program length produces similar characteristics in terms of the partnership relationship. The FMM training is short and specific; hence, the partnership is sharp and rigidly designed. The Black Hawk program and the SAIT-NT manufacturing technology program, which by contrast are years in length, tend to be loose and more flexible. In the longer programs, private sector partner commitments are not sharply defined. This allows these partners greater flexibility to deal with changes in the external environment that take place over the life of the training program.

• training that is particularly expensive, because of spoilage, physical danger or expensive facilities, tends to migrate to public sector or broad industry supported training institutions

Training that is particularly expensive, because of spoilage, physical danger or expensive facilities, *tends* to migrate to public sector or broad industry supported training institutions. However, this is not a rule. NT continues to maintain expensive proprietary training labs, while sharing other labs with public training institutions. PEI's strengths include its ability to focus on sectoral training, absorb spoilage, maintain an excellent safety record, and support very costly equipment through linkages. In Chinese Taipei there is a push to move semiconductor industry operating and maintenance personnel training into the Tze-Chiang Foundation because of the high costs. In turn, such a move will likely require a more rigid and directed partnership structure.

Larger, well established industrial partners reduce the risk for training organizations. Small and newer industrial partners make for riskier partners, and as a result their training needs are more often met through industry associations

• strong benefits for all partners is the hallmark of a successful partnership

Strong benefits for all partners is the hallmark of a successful partnership. Since the cultures of public sector training organizations and private sector industrial organizations are so very different, it is important that *all* the partners invest considerable energy into understanding and meeting the needs of the other. The most successful partnerships are built on years of experience during which the partners develop an understanding of the differing needs and regularly demonstrate their commitment to ensuring the partnership meets those needs.

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INDUSTRIAL TECHNOLOGY TRAINING PROGRAMS FOR WOMEN: Gender Issues & Program Success Factors

by Miriam Bailey

1.0 INTRODUCTION

This report examines and reports on the success of industrial technology training programs for women in the Asia Pacific Economic Cooperation (APEC) communities as a means of improving women's participation in the work force. Specifically, the report identifies factors which make these programs successful in terms of providing women with the ability and skills to gain employment in the industrial technology sector, a "non-traditional" sector for women.[1]

2.0 FRAMEWORK FOR THE STUDY

Industrial technology training is defined as: any instructional training program associated with or in support of any extraction, processing or manufacturing process including but not restricted to metal casting, extrusion, heat treating, injection, moulding, paper making, steel making, electronics, computers, automation, robotics, flexible manufacturing (FMS), computers aided design/manufacturing (CAD-CAM), laser technology and the like (see Hatton, 1995, pp. iii-iv). To accomplish this study, two major activities were undertaken. First, a review was completed of the literature on women in trades and technology. Second, following consultation with representatives of the APEC Human Resource Development Working Group, four industrial training programs for women in the APEC region were examined. Three of the four were visited for on-site evaluation.

This study is limited by reviewing only the literature on Women in Trades and Technology. The complementing literature on education and work, which would provide a broader contextual framework, was not included in this research project, nor is there included any description of women's rights legislation bearing on women's access to training and employment. Finally, the study reports only on women's participation in trades and technology: the participation of women in occupations where they constitute a majority is not considered. The study was inhibited by the lack of statistics on women's education and training (APEC, 1994; Pocock, 1992; Women in Trades and Technology [WITT], 1993, December), and by the APEC communities'

1. A sector is considered "non-traditional" for women when they constitute less than 30 % of the people in a particular job category (Canadian Automobile Repair and Service [CARS], undated; Patterson, undated).

small number of reported industrial technology training programs designated for women. Statistics on women's participation in the work force are a recent phenomenon, and there is still little information available on women in the work place and the issues surrounding their working lives (Organisation for Economic Cooperation and Development, 1994a).

Despite these limitations, it was anticipated that useful information could be gathered for APEC economies interested in improving women's employment opportunities. In particular, success indicators could assist policy making to link education and training with economic and social development. The links between economic agencies and government decision makers, on the one hand, and education and training institutions, on the other hand, are essential if countries are to match education and training with individual and national needs in a changing world economy (OECD, 1994b & c).

The study incorporates two assumptions. First, industrial technology training programs for women expand their employment opportunities and improve women's economic base. Second, the issues surrounding women's training and employment are similar in the APEC economies despite their economic and historical differences (APEC, 1994; Kamijo, 1994).

One caveat is raised. Regardless of country of origin, women are not a homogeneous group. They are different by life experiences, skill level, and class (Australia, 1991; OECD1994a). For example, the education and training needs and work expectations of aboriginal, immigrant and refugee women will differ greatly from the needs and expectations of women who are seeking to move from one work field to another.

3.0 LITERATURE REVIEW

Three sequential questions come to mind in relation to industrial training programs designated for women. First, why are such programs necessary? The simple response is that they improve women's participation in the work force. At present, women's access to training is limited, and what is available is mostly centred on training for a cluster of poorly paid occupations (Australia, 1991; OECD, 1994c; Wismer, 1988). The second question follows from the first. Why have women not had access in significant numbers to education and training? The answers are complex. Essentially, socialization patterns influence the role that women and men play in their individual communities. Traditionally, the role of women has been centred in the family: men are the providers. Women have not been expected to spend long periods in the paid workplace. As might be expected, education and training for women have been concentrated in service-related occupations that complement their family role, for example, health care, food services, and the retail industry. These occupations do not contain well-defined skills and opportunities for advancement (OECD, 1994b).

The third question is the following: How useful are industrial technology training programs for women in improving and increasing their participation in the work force? The literature indicates that, by themselves, they have limited usefulness: for

change to occur, values and attitudes must change (Wismer, 1988) and all the major agencies involved in training and employment must collaborate (Braundy, 1992; OECD, 1994c; Patterson, undated; Wessman LeBreton & Segal Loevy, 1992). The site visits undertaken for this study revealed that these programs can and do improve employment opportunities for women who have the prerequisite skills to enter and succeed in the training programs. A great many women, however, do not have the prerequisites. Furthermore, the programs do not address the traditional attitudes of society in general, and the industrial technology employment sector in particular, towards the roles of girls and women and the latters' place in the work force. Specifically, industrial technology training programs for women do not orient employers and male workers, who dominate the technical and the information technology world, towards accepting women graduates as employees and co-workers respectively. Not all employers have acknowledged that technological advances have greatly reduced the need for physical strength on the part of workers (OECD, 1994d). Most male workers in the trades believe that women are taking their jobs (Bohnen & Klie, 1990). Thus, additional strategies are required to provide girls and women with coping strategies to enter a variety of job sectors, and to change the culture of both society and the work force to facilitate new work experiences for women (OECD, 1994d, e, & f; Wassman LeBreton & Segal Loevy, 1992; Young Women's Christian Association, 1993).

• technical training programs can and do improve employment opportunities for women who have the prerequisite skills to enter and succeed in the training programs

3.1 Reasons for Improving Women's Participation

There are insufficient women in the paid labour force in most countries, including those of the APEC economies (Grandea, 1994; OECD, 1994a). Why is it important to improve the participation of women in the work world? The reasons are both economic and democratic.

Economists and national planners advise that human resources are surpassing natural resources as a country's most valuable asset for ensuring prosperity (Canada, 1991). The increasing internationalization of trade and monetary systems means that nations need a well educated and skilled work force if they are to compete in a world economy. Obviously, few countries can afford the luxury of excluding all those who traditionally, for a variety of reasons, have not had full access to education and training. The most important group that has been excluded systemically is women, a group that constitute 50 percent of the world population (Grandea, 1994). In a global economy, the contribution of women to advancing their own and their nation's prosperity is significant. Thus, increasing women's access to education and training is an important issue for most economies. In the more industrialized countries, demographic changes are taking place which affect the flexibility of the work force. The birthrate is falling which means that fewer school leavers will be entering the work world in the coming years. Consequently, the work capacity of the adult population is growing in importance. Since women make up half the adult population in these countries, their training for, and subsequent participation in, the labour force has become an issue of

national importance (Australia, 1991, 1993, New South Wales 1994a; Begarra, 1986; Canada 1984; Republic of the Philippines, 1995).

In addition to the economic arguments for extending education and training to all population sectors, the issue of equity has been gaining importance for a number of years. World organizations such as UNESCO have recognized that education is a fundamental right of all people regardless of gender, age, religion, race, and national origin. UNESCO has initiated action in many parts of the world to encourage countries to provide equal opportunity for girls and women to gain access to, and success in, education and training (Begarra, 1986).

In most parts of the world, including the APEC economies, women workers tend to be clustered in the service, retail, and clerical occupations (Australia, 1991; Patterson, undated; Pocock, 1992). Traditionally, these occupations have been considered "women's jobs". In these occupations, as mentioned earlier, skill competencies are poorly defined and categorized, with the result that the jobs are badly paid and do not have identified career paths (OECD, 1994b). Further, there is a noticeable dearth of women in science, trades, technology and engineering (Canada, 1993; Canadian Labour Market & Productivity Centre, 1993; Puddock, 1993). These occupations, traditionally the preserve of men, have well-defined knowledge and competency requirements, clearly identified career paths, and high levels of remuneration (Puddock, 1993). Economies need the full participation of women in order to promote national prosperity, and basic human rights demands full and equal opportunity for the participation of women in all segments of the labour force. Thus, there is both an economic and democratic rationale for women to have full access to better training and employment opportunities.

APEC economies have taken a number of measures to promote women's access to, and success in, education and training that responds to their individual needs and aptitudes in a wide range of areas, including those designated traditional and non-traditional (Australia, 1991, 1992, 1993, 1994a & b; Chinese Taipei, 1995; Grandea, 1994; Korea Manpower Agency, 1995). The literature shows that no single strategy is sufficient to make a significant difference in women's and men's attitudes to, and experiences in, the labour force. In fact, the literature states that a variety of strategies and programs are necessary (Pocock, 1992; OECD,1994c; Patterson, undated; Wessman LeBreton & Segal Loevy, 1992; YWCA, 1993).

• no single strategy is sufficient to make a significant difference in women's and men's attitudes to, and experiences in, the labour force; a variety of strategies and programs are necessary

The socialization issues affecting women's place in the work force and the strategies, including industrial technology training programs, introduced to improve and expand women's participation in the work force are outlined in the following section.

3.2 The Fragile Link

APEC (1994) confirms the fragility of the link between women's training and their success in the workplace. Until recently, it was assumed that education and training were key to securing employment particularly for minority groups who, because they

had not been visible in the labour market, believed that what they had to do was to demonstrate clearly their ability to be productive members of the work force (Spragge & Paschal 1991). This belief is based on the assumption that equal opportunity exists in the workplace for those with equal qualifications. Thus, it was reasonable to assume that if women want to improve their paid work situation, they need to become better educated and trained. The world is not that simple. Education and training by themselves are not sufficient. Barriers exist for women who want to enter certain job categories, barriers resulting from societal stereotypes and economic structures (Anisef & Axelrod, 1993; APEC, 1994; Begarra, 1986; Canada, 1984; Coulter, 1993; Mann, 1995; OECD, 1994d & e). The consequences of these barriers are reflected in the restricted access for women to education and training and their segregation into a small number of occupations which are poorly paid and provide little opportunity for advancement. Removing these barriers is one of the most important challenges facing nations as they strive to improve their prosperity through market competitiveness (OECD, 1994a, b, d & e).

3.3 Gender Stereotyping and Segmentation

"Specific learning about how to behave and act as women and men in society is called gender socialization" (Coulter, 1993, p. 1). Research shows that what children learn about their roles is central to their ideas about themselves and the course their lives will take (Anisef & Axelrod, 1993; Braundy, 1992; Mann, 1995). Girls and boys are given very different messages about how to behave. Mann (1995) states that boys are given what she calls a false sense of entitlement at the expense of girls. Girls are reared to be deferential and agreeable if not submissive; and they are expected to be supportive of others. In contrast, boys are encouraged to be adventurous, to experiment, and to be independent. By the time they are teenagers, girls have lost a great deal of their self-confidence (Anisef & Axelrod, 1993). Coulter (1993) claims that, by an early age, girls accept that they are not as good as boys. Boys, for their part, believe that they are entitled to more opportunities than girls. The self-confidence of girls and women is a critical issue to be addressed if they are to be successful in increasing their opportunities and earning power (Braundy, 1992; Canadian Labour Market & Productivity Centre, 1993; Wismer, 1988). Self-confidence is a critical issue in fields other than non-traditional ones: it surfaces in many professional training areas (Canada, 1993; Hicks, 1995).

Schools reflect the values of society and thus reinforce society's stereotypes. Not surprisingly, girls and boys follow different tracks in school, tracks that reflect society's expectations. Boys have a tendency to go into mathematics, science, and technology where they will acquire, throughout their student life, well defined and marketable skills. For the most part, girls are channelled into general education which very often doesn't translate into marketable vocational competencies (Pocock, 1992; OECD, 1994d & e). The term "educated but unskilled" is used to describe people with

a general education background (OECDe, p. 5). Thus, the separate education paths followed in school by boys and girls condition the kind of work available to them when they enter the labour force, and help explain the segregation of jobs by gender.

• values and attitudes towards the roles of women and their paid work must change in order to have systemic change in the workplace

What should happen for job segregation to diminish and eventually disappear? As stated earlier, values and attitudes towards the roles of women and their paid work must change in order to have systemic change in the workplace. In addition, those engaged in training and employment must work together to improve women's training and work opportunities. Research findings support the conclusion that the following strategies would prove effective in reducing the barriers.

- parents need to change the socialization pattern by which boys and girls are reared in the home: both boys and girls need to be encouraged to pursue a broad range of interests and learn to be responsible family and community members.
- schools need to effect change through: eliminating gender biased curriculum and sexist language, and the segregation of boys and girls into separate subject clusters; exposing all young people to a wide range of learning experiences; sensitizing both teachers and guidance counsellors to their often unintended gender biases; and involving parents and the community in instituting these changes.
- postsecondary institutions need to implement structures, programs, and services that respond to adult students, many of whom are returning to the education system after a period in the work force.
- governments need to take responsibility for creating partnerships to link government policy and funding agencies with education and training systems and the employment sector for the purpose of developing and implementing policies that promote the full participation in the work force of all citizens according to their abilities. Furthermore, governments need to implement equity legislation that protects women from discrimination and aggression in the work world. According to Wessman LeBreton & Segal Loevy (1992), women should be able to work in a climate where success or failure "should be based on a woman's ability to do the work, not on her ability to cope" (p. 23). There is no suggestion in the cited research that equity legislation should provide special privileges for working women: what is required is a work environment where all workers are treated equally with respect.

Many governments, including APEC economies, have instituted changes in both their education systems and labour forces that are addressing the second, third, and fourth strategies (Australia, 1991, 1993, 1994a & b; Canada, 1984, 1993; Chinese Taipei, 1995; Faris, 1992; Grandea, 1994; Korea Manpower Agency, 1995; Republic of the Philippines, 1995).

3.4 Improving Girls' and Women's Education, Training, and Employment

In contrast to the lack of cited research on industrial technology training for women, there is information available on other activities that improve the academic and social education of girls, and promote women's economic and personal well-being and job participation in science, trades, technologies, and blue-collar operations. Only activities that enhance the immediate and future work opportunities of girls and women are reported here.

One specific activity that has been introduced in Canada to orient girls to trades and technology is the GETT program - Girls Exploring Trades and Technology (WITT, 1993, October). This program reduces the anxiety girls often face in relation to science, trades, and technology, and increases girls' beliefs in their ability to handle tools and understand science and technology. The GETT program is now offered in several Canadian provinces. The program is implemented at summer camps, run by WITT (Women in Trades & Technology) women, and has the following goals:

- orienting 12 - 13 year old girls to a range of curriculum options before they decide on study choices that affect their future careers;
- demystifying tools, trades, and technology;
- creating a base for understanding science and mathematics;
- building girls' self-confidence;
- providing role models of women who have succeeded in science, trades, and technology.

• the GETT program reduces the anxiety girls often face in relation to science, trades, and technology, and increases girls' beliefs in their ability to handle tools and understand science and technology

The training and employment activities developed and implemented in recent years to integrate women into trades and technology and improve their ability to earn a living can be categorized as follows: (1) bridging and exploratory programs; (2) mathematics, science, and technological upgrading; (3) pre-apprenticeship training; (4) industrial technology training programs; and (5) recognition of prior learning (Braundy, 1992; Patterson, undated). In all these programs, special attention is given to developing the self-esteem of women. Also, a considerable effort is given to the recognition of prior learning (Australia, 1992; OECDe). For the most part, the least emphasis has been placed on the provision of industrial technology training programs for women (Australia, 1991).

Overall, these activities have components that: provide academic and technical skills based on adult learning principles within a framework of lifelong learning and on the ways in which women learn; introduce women to the realities of the "non-traditional" work world and how to survive in that world; provide women instructors who can act as role models; assist women to identify their abilities and acquired skills; promote the self-esteem of women; and assist women to secure either further training or immediate employment.

Bridging and exploratory programs are similar: both expose women to the realities of the world of trades and technology; women learn the use of tools and acquire basic technical skills that apply to a range of occupations; and women are then helped to make informed career choices and enter further training to acquire job entry skills in a particular trade (WITT National Network, undated). Bridging programs (Bohnen & Klie, 1990, Patterson, undated) are implemented by employers who take women from clerical and service jobs where women constitute the majority and give them training in trades and technology within the same firm or organization. On completion of the program, the women are transferred into the firm's trades area.

Because girls and women are often channelled into a limited number of education and training programs, they often do not have the necessary background to enter the fields of science and technology. Many educational delivery bodies, particularly adult education ones, now offer special upgrading courses and programs for women. These programs range from science and mathematics upgrading to pre-apprenticeship training.

• women acquire a range of skills and life experiences in their traditional area of employment and in their unpaid work, and many of these skills are transferable to "non-traditional" training and employment

Women acquire a range of skills and life experiences in their traditional area of employment and in their unpaid work. Many of these skills are transferable to "non-traditional" training and employment. Furthermore, in many APEC economies, education and training bodies are collaborating with the employment sector to recognize "prior learning" (Australia, 1992; OECD, 1994a, e). Such recognition is particularly useful in the employment sector when employees, who have acquired specialized skills in the workplace, apply to technical institutes for formal training and certification.

The dearth of cited research on industrial training programs designated for women suggests that few countries have such programs. There are two possible reasons for the lack of such programs. First, there is evidence that many women do not wish to enter designated industrial technology training programs because of the fear that they will be considered inferior to regular programs (Canadian Automotive Repairs and Service [CARS] undated; OECD, 1994d). Second, it could be claimed that such programs are not necessary, given the existence of exploratory and upgrading opportunities through which women can acquire the skills and abilities necessary to be admitted into existing industrial technology training programs.

Research shows, however, that designated programs for women, who wish to enter industrial and technological jobs, are beneficial. The programs: help women gain self-confidence through studying and learning from other women (Australia, 1991); introduce a learning methodology based on women's ways of learning (Braundy, 1992; WITT, undated); provide counselling and support services, often including financial assistance (Australia, 1993); and help women acquire on-the-job experience and employment on completion of the program (Pocock, 1992).

The research on the work preparation programs for delayed or immediate employment outlined in this section shows that recruitment to, and retention in, the work related programs for women are important indicators of program success (Australia, 1991, 1993; Canada 1993; Council of Ontario Universities, 1988; Korea Manpower Agency, 1995; Puddock, 1993). For the programs that lead directly to employment, the employ-

ment success rate of women is an equally important indicator of program success (Advisory Council on the Status of Women, 1995; Australia, 1991, 1993; Canada, 1993; Canadian Automobile Repair and Service (CARS) Network, undated; Posen & Novogrodsky, 1990; Wismer, 1988).

In summary, traditional gender stereotypes and gender segregation in education, training, and the work force have limited the ability of women to fulfil their potential as individuals and citizens. Recent social and economic changes require the full participation of women in the world of work. Consequently, countries have improved and continue to broaden women's access to training and employment.

APEC economies have exploratory and upgrading programs for women, but provide little evidence of industrial technology training programs aimed at women (Australia, 1991, 1994b; Pocock, 1992). Further, there is little in the way of cited research, making it difficult to assess what is available (Pocock, 1992; WITT, 1993, December). Access to Canadian data sources was more readily available than those of other economies, and the programs visited for this study are Canadian. However, attitudes towards men's and women's roles, and the resultant differentiation in terms of training opportunities, include many similarities across the APEC region (APEC, 1994; Begarra, 1986; Kamijo, 1994; Patterson, undated). As a result, although the specific programs studied are from Canada, the success indicators that have been identified should be useful to policy makers throughout the APEC membership.

4.0 INDUSTRIAL TECHNOLOGY TRAINING PROGRAMS FOR WOMEN

APEC economies have concentrated on providing for women's bridging, exploratory, and science and mathematics upgrading programs, as well as counselling and support networks. This concentration was not unexpected, particularly in light of the literature review. Given that very few industrial technology training programs for women were reported in the APEC region, only three were visited and analyzed. A fourth, Korea's Anseong Women's Industrial Masters' College, has also been reviewed as this College's mission, programs, curricula, entrance qualifications, structures, and services were designed specially for women and complement the scope and focus of the study.

"*Recruitment, retention, employment* is the catch phrase of training programs which include significant participation by women. The three are inseparable and are key to the success of skills training for women" (Canadian Automotive Repair and Service, undated, p. 11: italics are CARS'). The same three elements were also outlined in the literature review as the main indicators of program effectiveness and were reiterated by the personnel interviewed during the site visits. As a consequence, "recruitment, retention, and employment" constitute the framework for assessing the programs presented in this section.

The following commentary on the three site visits is based on an examination of each program's documentation and an analysis of the information gleaned from the interviews.

4.1 Canadian Programs

The three Canadian programs depend on funding from the Federal Government: the first two were specifically designated for seriously economically disadvantaged women and were very similar in program content and structure; the third was designed to accept an equal number of men and women. All three have the following characteristics that support women's recruitment into, and their retention in, the programs, as well as the subsequent employment of graduates: (1) the programs were developed to meet identified specific needs; (2) the project managers are women who act as role models for the participants and who understand how women learn; and (3) the programs' structures provide the support system that women need to develop both the confidence and the technical skills to secure employment in what are non-traditional work areas for women.

ITCW/Zalco Program, Sudbury, Ontario (founded 1983)

• the program is practical in nature and the skills learned are transferable within a number of industries

The purpose of the Industrial Trades Centre for Women of Sudbury Inc. (ITCW) is to prepare women for both entry-level employment in trades, technology and operations (TTO) and further training in more specific trades areas. The program is practical in nature with an external on-the-job component, and trains the women in the use of hand and electrical tools, lathes, grinders, and milling machines: the skills learned are transferable within a number of industries.

While it is primarily involved in training, the Centre also has a business component - the manufacturing by the program's participants of zinc alloy products under the trade name Zelco. Specifically, Zelco is a casting and machining operation which designs and produces quality zinc alloy products on demand for industrial customers.

The training program was designed for women who have difficulty in securing employment because they lack particular work and related skills. The Centre's mandate is to provide community based training, and the mission statement describes the program as "a unique opportunity for women to enhance their personal development and acquire general industrial skills while manufacturing a quality assured product" (ITCW/Zalco 1994). The criteria for the recruitment of women who need the skills provided by the program are determined by the local regional office of Human Resources Development Canada (HRDC), the Federal Government Department responsible for training and employment. The local office works collaboratively with ITCW to ensure a steady intake of women. ITCW is responsible for ensuring that the eligible candidates possess the requirements for succeeding in the program.

The program operates on an adult learning model. Learning is individualized, outcomes are specified, and progress is competency-based. On-the-job training is integrated in the program and there are two four-week work study periods. The program can accept forty women each year and operates on a continuous intake model: a maximum of 15 students at any one time can be accommodated. Participants receive 1,120 hours of training spread over 28 weeks. Given the revenue generating aspect of the program, participants are required to function as employees in this small business

• participants are required to function as employees in this small business enterprise

enterprise. Thus, they are expected to be punctual, to be cooperative, and to respect the Centre's regulations, facilities, and work culture. The zinc alloy products that the participants produce must meet industrial market standards. The Centre has an evaluation and follow-up system that tracks program retention levels, job success rates, and graduate entry to more advanced training. The Centre also offers, at intervals, specially designed short courses for women who require additional training and upgrading in related trade and technology areas.[2]

ITCW's staff includes a manager, secretary, two vocational instructors, and a life skills teacher/coach. The participants have access to a provincial apprenticeship (for women) coordinator who works in collaboration with Sudbury's community college and assists program graduates to enter an appropriate apprenticeship field, should they so desire.

The Centre has its own shop equipped to provide the participants with experience in lathe and milling operations, welding, casting, foundry and bandsaw work, drilling and tapping, grinding and sanding, hand and precision tool usage, and manufacturing processes. The shop also has a drafting and blueprint reading facility.

In order to meet the special needs of the women, ITCW implemented a holistic training approach which, in addition to the training component, includes support services and counselling as integral program elements. Furthermore, women learn employment skills, physical fitness, and are provided with academic refresher courses in mathematics and science. The revenue generating element of the program teaches women how to communicate with outside agencies, manage time on the job, and work as a team. ITCW provides a weekly salary based on each individual's attendance and performance record.

• in order to meet the special needs of the women, ITCW implemented a holistic training approach which, in addition to the training component, includes support services and counselling as integral program elements

All these elements, together with the individualized learning component of the program, ensure a high retention rate and provide an infrastructure for the participants to acquire self-confidence, an essential element for their successful entry into both the job market and further training in specific trade or technology areas. The interviews indicated that, for the majority of the women, the development of self-confidence and self-worth are the greatest challenges of their training period. For the period 1984-1994, the retention rate averaged 85 percent.

• interviews indicated that, for the majority of the women, the development of self-confidence and self-worth are the greatest challenges of their training period

ITCW is managed by a Community Advisory Board. The Board is drawn from local employers, industry and professional agencies, women's groups, and local community bodies. It develops policy for the Centre, and provides advice on program content and delivery. The Board assists the Centre to ascertain and meet the employment needs of the local environment, helps with on-the-job training, and provides links between graduates and employers. The success rate of graduates in securing employment has averaged 75 percent from 1984-1994. Zalco and the large local mining com-

2. Several APEC economies offer short program of this kind. For example, Chinese Taipei (1995) offers a sixty-hour training program in AUTO/CAD at the Taishan Vocational Training Centre in Taipei. This program is offered on a part-time basis in the evenings for working women.

pany, Inco, have an agreement whereby Zalco manufactures zinc products to Inco's specifications for use in its plant.

The following activities are crucial to the program's success in the recruitment, retention, and employment of the women:

- assessment of community training requirements and matching these with program content and the participants' abilities and preferred learning styles:
- payment of a weekly wage that enables the women to provide for themselves and their dependents during the training period;
- provision of support systems that help participants to acquire self-confidence, resolve personal problems, and learn how to secure employment;
- linking training to the availability of jobs in trade, technology and operations (TTO), and providing advanced training in specific trade and technology areas;
- creation of partnerships with the employment sector, other training agencies, and government bodies to ensure appropriate learning outcomes and employment of the program's graduates;
- implementation of accountability and evaluation systems to make sure that program outcomes reflect general industrial training standards.

SKILTEC, North Bay, Ontario (founded 1982, closed March 31, 1995)[3]

SKILTEC (formerly Women in Non-Traditional Training) was started at Canadore College, North Bay's community college, for women with difficulties in securing employment. The mandate given to SKILTEC was to provide these women with generic, transferable job-entry skills in trades, technology, and operations (TTO): a literacy component was also included. Specifically, the program was designed to allow participants to acquire entry level skills in welding, sheet metal, industrial spray painting, flexible manufacturing and processing, and blue print reading. SKILTEC was registered as a non-profit corporation which ran a business where the participants manufactured for sale products such as standard utility trailers, tool boxes, metal stairs and railings. These items were usually manufactured to individual specifications.

SKILTEC, in a similar manner to ITCW/Zalco, provided a climate where participants had opportunities for personal growth, the acquisition of life and employment-related skills, and upgrading in mathematics and language communication skills. Direct involvement in the production of a saleable commodity helped the women to

3. This program was cancelled at the end of the 1994 fiscal year, and the last group of students completed their studies in mid-February, 1995. As a result, only SKILTEC administrative personnel were interviewed. No meetings were held with women graduates or instructors as they had all departed. Nevertheless, an analysis of the program was possible, and its successful elements and identified problems provide useful information for those involved in the development, organization, and delivery of training programs for women.

gain self-confidence as well as familiarity with the realities of the work world. In addition, the women were given physical fitness training and exposure to health and safety issues. It was intended that those skills would allow the women to develop a higher level of self-esteem, acquire the ability to become employable in a trade or technical field, and secure and keep jobs. Like recruitment for the ITCW program, the regional office of Human Resources Development Canada (HRDC) selected the participants with the collaboration of the SKILTEC staff.

The program was 32 weeks in duration and accommodated 40 women per year on a continuous entry basis. The production unit attached to SKILTEC enabled it to introduce an employee-employer relationship with the participants, who were paid a weekly wage and benefits. Instruction was individualized, competency-based, and included four weeks on-the-job training with a local employer.

The program and instructors were evaluated at regular intervals by both the participants and a committee of the Board of Directors. Graduates received assistance with their job search and there was regular follow-up with graduates and employers. SKILTEC'S resources were the same as those of ITCW - a full time staff comprising a project manager, a secretary, two vocational instructors and a life-skills teacher. The participants also had access to the provincial Women into Apprenticeship coordinator who helped those who wished to pursue further training in an apprenticeship trade.

Similar to ITCW's Zalco, SKILTEC had a specially designed shop to provide participants with hands-on activities in drill press operation, vertical band saw operation, shearer operation, welding, grinding, soldering, jig saw operation, electrical wiring and testing, blueprint reading, safety practices, industrial spray painting. The sole purpose of SKILTEC was to provide marketable skills to women who were severely limited in their ability to secure steady employment, and recruitment was confined to such women. They received a fully integrated set of experiences that combined life (including health), employment, and job skills. Teaching methods were tailored to support women's learning styles.

• the sole purpose was to provide marketable skills to women who were severely limited in their ability to secure steady employment, and recruitment was confined to such women

SKILTEC's revenue generating operations created a small business environment where the participants manufactured products specially designed to customer specifications. Thus, the women learned, first hand, the realities of the work place. Towards the completion of their training, the participants had the opportunity to design and manufacture a product of their individual choice: the manufactured product was evidence of their newly acquired skills and abilities. The average retention rate of 85 percent over the 1984-1994 period matches that of ITCW.

SKILTEC had a Board of Directors composed of an equal number of female and male volunteer representatives from the local community. The Board's mandate was to ensure that SKILTEC focused its training on local industrial needs, and to advise on likely areas of employment. It was intended that the Board members' experiences and local contacts would help with work study placement for participants and their subsequent employment. For the period 1984-94, the average employment placement rate of graduates was just under 80 percent.

• the Board's mandate was to ensure that SKILTEC focused its training on local industrial needs, and to advise on likely areas of employment

From an analysis of the interviews and SKILTEC's documents and records, the following factors were identified as being critical to the program's success in training and retaining participants and in helping them to get jobs:

- the close link between the program and the local employment market to ensure that the participants were prepared for available job opportunities;
- the strong relationship between the program characteristics and the women's personal, learning, employment, and job needs;
- the capacity to treat the participants as "employees" who manufactured a product to market standards, and who were paid a weekly wage that ensured self-sufficiency during the training period;
- the implementation of an institutional evaluation policy that provided feedback on individual progress, staff effectiveness, program relevance, and customer satisfaction.

Career Choices in Motive Power: Red River College, Winnipeg, Manitoba

The Canadian Automotive Repair and Service (CARS) Institute surveys the needs of the Canadian automotive repair and service industry on an ongoing basis. Aware of the increasing demand for new, specialized training programs at the technician level in the automotive repair, service, and parts distribution sectors of the industry, CARS secured funding from the Federal Government in 1993 to pilot a two-year Motive Power[4] Technician Career Choice Diploma Program.

• the shrinking number of young people entering the job market (declining supply) coupled with the expansion of the automobile industry (increasing demand) required that training opportunities be made available to all sectors of the population in order to meet the demand

In addition to supporting employment equity, CARS identified three other reasons specifically to include women in its training program. First, the shrinking number of young people entering the job market (declining supply) coupled with the expansion of the automobile industry (increasing demand) required that training opportunities be made available to all sectors of the population in order to meet the demand. (At the time CARS examined this issue, women constituted less than one percent of those trained and working in the automotive industry.) Second, changes in the way the industry does business require that training includes interpersonal skills, increased literacy, computer applications and administrative expertise, skills that many women possess. Third, an increasing number of new car purchasers are women, and they expect to see women in the automotive business. In 1992, women purchased 46 percent of all new cars in Canada, and it is anticipated that this percentage will increase to 60 percent by the end of the decade (CARS, undated, p. 7). For these reasons, the new program was designed to recruit a significant number of women in each of the three piloting colleges. Red River College in Winnipeg, Manitoba, the central Canada pilot college, was visited as part of this study.

CARS identified four essential elements in the Career Choices in Motive Power Program: (1) a curriculum that included both technical (electro-mechanical knowl-

4. The term 'Motive Power' covers all types of vehicles and includes heavy equipment.

edge) and business management (computers, sales and marketing, financial, communications) skills; (2) a female participation rate of 50 percent; (3) the opportunity for participants to select an area of specialization in one of sales and marketing, parts distribution, technical writing, fleet leasing and management, and automotive repair; and (4) employment of all graduates in the automotive industry. Graduates would have both business management skills and the necessary technical knowledge base to secure entry level jobs in their area of specialization.

To recruit and retain women, the program emphasized a learning environment that recognized the relational learning style of women, special counselling and support services tailored to the needs of adult women learners, exposure to the motive industry's multiple career options where employment opportunities exist, and lifelong learning possibilities that increase job mobility. The program is based on CARS' Standards. These detail the competencies that are expected of graduates in each area of specialization. A Standard, which is a set of required competencies, was developed for each of communications, mathematics, science, management, marketing, computers, service and maintenance applications, and testing and diagnosis. In practical terms, the different sets of required competencies ensure that participants acquire a background in applied mathematics, science and electronics, so as to master the technical aspects of the automotive industry and use effectively precision measuring equipment and computers; read, understand and follow sophisticated service manuals; and demonstrate deductive reasoning skills in order to diagnose and evaluate problems.

• the program emphasized a learning environment that recognized the relational learning style of women, special counselling and support services tailored to the needs of adult women learners, exposure to the motive industry's multiple career options where employment opportunities exist, and lifelong learning possibilities that increase job mobility

The new two-year program started in three Canadian community colleges in January 1994. It is evaluated quarterly by both the individual colleges and CARS. At Red River College, approximately twenty students, slightly more women than men, were accepted into the pilot program. Instruction is competency-based, and women have the opportunity to work in teams and learn in ways that suit their individual learning styles. Overall, the delivery of the program is diverse and includes seminars, independent and group learning, research projects, and student presentations. The program consists of 32 weeks each of technical and management training. In addition, participants have two work study experiences supervised by the college in collaboration with a host employer. The women in the program were given a two-week orientation program prior to the starting date to ensure their familiarity with the basic technical aspects of the automotive industry.

At Red River College, as well as at the other college sites, there is a designated instructor leader who operates the program and leads the team of instructors who teach the different specialized components. The program has its own shop, lecture rooms, and computer hardware and software. In the shop, participants work on vehicles and heavy equipment under the supervision of highly trained instructors. Students interested in the more technical aspects of the industry are given the opportunity to prepare for entry into apprenticeship where they can become certified Automotive Service Technicians after further training.

The unique elements of this pilot program reflect the three goals of recruitment,

• *important program elements include pre-selection into the program, a strong instructor-led orientation session, a teaching methodology based on the relational learning style, a two-week introduction session for female participants, and an on-going monitoring and evaluation system*

retention, and employment. Important program elements include pre-selection into the program, a strong instructor-led orientation session, a teaching methodology based on the relational learning style, a two-week introduction session for female participants, and an on-going monitoring and evaluation system. The recruitment process in each of the three pilot areas included newspaper advertisements and outreach activities, an information session for potential candidates, a pre-test to ensure that applicants had the required academic knowledge and abilities in addition to a high school leaving certificate, and a personal interview. CARS, the three colleges, and Human Resources Development Canada (HRDC) agreed that the selection of strong and committed participants was necessary for the facilitation of a high retention rate and a successful program.

The week-long orientation for the instructors included the development of a team approach to the delivery of different learning modules, exposure to the principles of adult education and relational learning, integrating business and technical skills, and creating a welcoming and collaborative climate for both the women and men participants.

In addition to the evaluation system based on CARS' Standards, the program has a quarterly monitoring and evaluation visit from the CARS project manager who "takes the pulse" of the program through interviews with students, teachers, program administrators, and community partners. Problems are identified and suggestions for improvement are discussed and addressed.

The women and men participants are all adult learners who have for the most part been made redundant through job abolition. As a result, most participants receive a living allowance through Canada's unemployment insurance scheme. At the interviews, it was stated that without the training allowance most of the participants would not have registered for the program.

• *without the training allowance, most of the participants would not have registered for the program*

From the outset, local firms and agencies in the automotive industry collaborated with CARS and the colleges by providing program advice and support for the on-the-job portion of the program. The Women in Trades and Technology (WITT) organization, the regional offices of Human Resources Development Canada (HRDC), and local apprenticeship bodies helped to identify criteria and procedures for the recruitment of women participants and develop a support structure for retaining them. The first graduates are expected on the job market in the summer of 1995, and local firms are committed to help with placing graduates according to their specializations. As of March 1995, two-thirds of the way through the program, the retention rate at Red River College is 86 percent.

The analysis of both the program documentation and the interviews at Red River College has identified seven program characteristics that have contributed significantly to the success of the pilot program. These include:

- program design and curricula that is responsive to industry needs and provides graduates with job-ready skills;

- a recruitment process that selects capable and motivated women and men;
- orientation workshops for both instructors and women participants to help them to become efficient teachers and learners;
- recruitment of a similar number of men and women into the program, the result being the fact that women are treated in the same manner as the men in the program[5]
- an approach to teaching that recognizes the relational learning styles of both men and women;
- quarterly evaluation by CARS personnel which facilitates the identification and solution of problem areas;
- a living allowance for the participants.

• women in the program were not in favour of industrial technology training programs designated exclusively for women

The women in the Red River College program stated that they were not in favour of industrial technology training programs designated exclusively for women. They wanted the same kind of program that men receive, and felt that this could only be achieved when both men and women enroled in the program. The balanced male and female participation rates allow the women to develop an understanding of the culture of the automotive working place, and prepare for it. The women also stated that by exposing men to women in the training environment, the men would appreciate better the presence of women in the automotive work force.

• balanced male and female participation rates allow the women to develop an understanding of the culture of the automotive working place, and prepare for it

4.2 APEC Programs

Anseong Women's Industrial Masters' College

Anseong Women's Industrial Masters' College, created in 1986, has as its motto - "sincere humanity, creative outlook on occupation, and progressive spiritual strength" (Korea Manpower Agency, 1995, p. 2). The College was formally opened in 1991 and the first technician level courses in industrial technology were offered in March 1994. It will be some years before data are available on the employment of the women graduates.

The College offers industrial technology programs in precision measurement, electronics, mechanical design, and information technology. They conform to the scope and focus of industrial technology training programs as defined at the beginning of this report. The Republic of Korea (1995) is committed to improving the quality of its work force, particularly in science and technology so that the country can be economically competitive in a global economy. The high level training provided to

5. The gender distribution has produced a teamwork approach to learning. In addition, there is evidence to suggest that women help the men with computer applications and communications, and men help the women with some of the technical applications. Both the women and men have learned to work collaboratively, and this bodes well for their effectiveness in the workplace after the completion of the program.

Korean women at Anseong College reflects the national priority.

The objectives of the training programs are: "to train sincere and polite women technicians; to train women technicians with specialized knowledge and clear view of nation and occupation; and to train women technicians with creative and progressive attitude to meet high-tech industrial society" (Korea Manpower Agency, 1995, p. 4). All applicants must have a high school leaving certificate, be less than 25 years old, and be physically fit. The curriculum includes general subjects, related theory and practice, and optional subjects. Related theory and practice account for 35 percent and 45 percent respectively of the curriculum. Optional and general subjects take up 10 percent each. General subjects include vocational ethics, physical education, English, mathematics, production management, computers, and industrial health and safety.

The industrial technology training programs of precision management, electronics, mechanical design, and information technology are structured in a similar manner. All have clearly defined course outlines and identified employment fields. Furthermore, the related theory components and the practical training skills are specified for each program. The training goal for each learner is to achieve certification as Craftsman or Class 11 Engineer in the particular field.

An institutional evaluation system is in place and women take state examinations in their respective skill areas. The participants are provided with practical work experience, language and computer training, employment guidance and follow-up services. With the exception of Information Technology, the programs accept 40 women each year. Participants receive 3,200 hours of training over a two-year period.

The College works in partnership with the Korea Manpower Agency in recruiting and selecting the women participants, in implementing and evaluating programs, and in participant certification. The Agency also collaborates with the College on identifying and resolving work-related issues such as employment placement. This partnership facilitates the implementation of the financial support systems.

• the Anseong Women's Industrial Masters' College incorporates several of the key success elements outlined in the cited research and supported by the three Canadian training program site visits

The Anseong Women's Industrial Masters' College incorporates several of the key success elements outlined in the cited research and supported by the three Canadian training program site visits: (1) government and training partnerships; (2) financial and personal support systems for the participants; and (3) a participant and program evaluation system.

5.0 CONCLUSIONS AND IMPLICATIONS

Key indicators for program success that were identified in the site visits correspond to those identified in the cited research. These indicators, therefore, can be recommended to governments, colleges, and professional training bodies that are implementing industrial technology training programs for women. They include:

- the collaboration of the industry and its major employers with the funding and delivery agencies to identify the job needs of the industry, advise on the

knowledge and skills required by graduates, assist with program development, provide on-the-job training, and support graduate placement;

- the implementation of support systems that include counselling and advising services, financial assistance for the participants, upgrading in mathematics and science, sensitivity workshops for instructors on how women and adults learn, and help with securing employment;
- the opportunity for participants to manufacture products for sale and thereby developing business experience;
- the availability of ongoing funding in order to permit the development and implementation of a plan that would maximize recruitment, retention, and employment, and permit the creation of a reliable information base on industrial technology training programs for women.

Industrial technology training programs designated soley for women can be very effective. On the other hand, the CARS Automotive program model, with an equal intake of men and women, is proving to be successful also. Obviously, the high number of women is a significant factor.

There is a need to develop data bases and undertake research on training programs for women. Such an investment would facilitate government planning, program development, implementation and evaluation, and employer participation in training and employment. In turn, these activities would promote women's advancement in the world of work, producing economic and social benefits for society as a whole.

• there is a need to develop data bases and undertake research on training programs for women; these activities would promote women's advancement in the world of work, producing economic and social benefits for society as a whole

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COST-BENEFIT ANALYSIS AND INDUSTRIAL TRAINING: A Case for Minimizing Objectives

by Michael Hatton & John Holland

1.0 NEW PERSPECTIVES

This is an essay on cost-benefit analysis for education and training appropriate to the circumstances of international trade and competition in the mid 1990s. The opportunity to write a paper that would complement the recent survey titled *Exemplary Training Models in Industrial Technology* (see Hatton, 1995), and its follow-up conference[1], focused the authors' attentions on the industrial training programs reported therein.

A feature of the program descriptions and evaluations presented in this survey is the frequent demonstration that, across the APEC economies, there are training programs serving the same ends, i.e., they are training workers to do the same, or very nearly the same, jobs. But, however similar their intents, even their products, these programs operate in accord with markedly different policies, and pursue very different strategies and tactics. The training of aircraft mechanics is one of the more striking examples of this phenomena. Such variety in what purports to be the training of one type of worker to the same competencies and credentials, is more interesting for the fact that these are workers in an industry noted for recent and continued rapid expansion.

• across the APEC economies, there are training programs serving the same ends; but, however similar their intents, even their products, these programs operate in accord with markedly different policies, and pursue very different strategies and tactics

The rapid growth of the airline industry has characterized almost all APEC economies, and especially those in Southeast Asia. Moreover, this expansion is projected to continue well into the next decade. This fact motivated the authors to pay particular attention here to the business of training mechanics for airlines. Accordingly, much of what follows with regard to cost-benefit analysis and industrial training is viewed from the perspective of programs training these mechanics, and some especial attention is paid to the varieties of policies and conditions pertaining to these programs in the APEC economies of Southeast Asia.

As Prest and Turvey (taken from Layard, 1972, p. 73) have demonstrated, there is nothing arcane about the term "cost-benefit analysis" and the questions it implies.

> Cost-benefit analysis is a way of setting out the factors which need to be taken into account in making certain economic choices. Most of the choices to which

1. The book documented the results of an 18 month survey of industrial training programs among the APEC membership. The conference was a follow-up activity, held in Toronto, May 13th - 15th, 1995, to discuss in detail 18 of the 53 programs described in the book. Together, the book and the conference formed the basis for the APEC-HURDIT Exemplary Models Project (EMP).

> it has been applied involve investment projects and decisions - whether or not a particular project is worthwhile, which is the best of several alternative projects, or when to undertake a particular project. We can ... apply the term 'project'... generally ... Cost-benefit analysis can ... be applied to proposed changes in laws or regulations, to new pricing schemes and the like. An example is ... proposals for regulating traffic on urban roads. Such schemes involve making choices along the same lines as investment schemes.

Under the conditions of trade and competition that will prevail during the first decade at least of the 21st century, will industrial training programs be subjected to more severe analyses of their worth? Will cost-benefit analyses be the conceptual tool employed in the rationalization of policies, strategies and tactics for industrial training? In the pages that follow, such questions will be directed especially to the industry of commercial aviation. However, these same questions could be directed to the whole of the phenomenon we know as industrial training, or to other industries and sectors within it.

In addition to motivations already mentioned, this study reflects a desire to exploit the Exemplary Models Project, both the book and the conference, to test the validity and worth of the information and ideas here presented. That there might be exemplary models in the mundane but vital business of industrial training, and that a large number of people from all corners of the pacific hemisphere would come together to talk about them at a conference in Toronto, suggests a rare opportunity to direct attention to an important feature of the new economic order - a system of more trade, freer trade, faster and greater international capital movements, and rapidly shifting relative advantages in international trade. That feature is the complication, and the blurring, of the distinctions between competition and co-operation. Keen competition in trade, no less than in sport or in science, presupposes an enormous amount of co-operation. Whether a meeting to celebrate exemplary training programs, with all its attendant preparations and consequences, is better classified as an exercise in co-operation or competition, we will leave unanswered.

• keen competition in trade presupposes an enormous amount of co-operation

Much of the world, including most nations of the Pacific, is recovering from a recession at the beginning of this decade that was notable for both intensity and extent. The recession itself was not notable for duration. Most nations returned after a few quarters to quite respectable rates of growth. What so many nations, especially the relatively rich and long-industrialized nations, are enduring still is the cure. Firm after firm, in country after country, resorted to the therapies of down-sizing, cost-cutting, and the reduction of payrolls. Most firms survived the therapy and have emerged more efficient producers and more effective competitors. The adjective most used is "leaner."

• the "leaner" training institution appears to be the hallmark of the future of technical education, particularly in a world of freer trade

The therapy was not, however, confined to industrial firms or commercial corporations. It spread to institutions of many sorts, including those for education and training. At the risk of beginning this essay with a conclusion, the "leaner" training institution appears to be the hallmark of the future of technical education, particularly in a

world of freer trade.

As firms compete to make the most effective use of the land, labour and capital available to them, and to maximize the satisfaction of consumers, they cooperate in many ways, not the least being the construction of efficient markets. In the course of this, they exchange information, much of it in deliberate, formal ways, as in conferences and conventions, but even more in the form of necessary exchanges that accompany buying and selling.

As managers know more and more about what their customers want, what their actual and potential suppliers can bring to them, and what their competitors are doing, they must behave more like their competitors, when what their competitors do is smarter or more efficient. It follows, of course, that what they themselves do that is smarter, their competitors will do soon enough. If what they do is more efficient or more competitive not because it is smarter, but because of a relative advantage, such as lower wages, or less expensive energy, managers will soon enough find themselves dealing with restructured competitors better able to counter that advantage. Not immediately, perhaps, but "very soon" compared to the neutralizing of comparative advantages in economic history.

People in industrial training, and indeed in all types of training, were surprised during the recession and the years of restructuring, to hear themselves (more accurately, the budget "item" or "line" that pertains to them) quite often described as expendable, even "luxury" components of corporate expenditure. Trainers, after all, are a small step from the no-nonsense business of production itself. The fact remains, however, that in-house industrial training has been, in the main, and for most of its history, utilised most often, most intensely by firms with monopoly profits and accompanying characteristics such as long-serving employees, administered wages, a vertical internal-bureaucracy and a need for conspicuous expenditures such as corporate jets.

• in-house industrial training has been, in the main, and for most of its history, utilised most often, most intensely by firms with monopoly profits and accompanying characteristics such as long-serving employees, administered wages, a vertical internal-bureaucracy and a need for conspicuous expenditures

However, the new industrial order is characterized as much by deregulation as by freer trade. The two policies together suggest that the in-country monopoly privileges, that once assured monopoly profits to some firms in relatively closed economies, will not be tolerated. Some favoured firms will lose their monopoly revenues and profits under conditions of freer trade. If they are to survive, these firms will become leaner organizational structures. Training programs, if they survive, will not often be the same operations that they were before reorganization.

Recessions, for all their reputed heuristic value, probably help us only to see a little more clearly, a little earlier, what is becoming apparent anyway. During the recent recession, many firms became painfully aware of their eroding monopoly power - and profits. Many of these firms demonstrated a remarkable will to survive, even to profit handsomely, in a less regulated, more competitive environment. North American banks are examples of firms whose monopoly privileges have been eroding for a long period of time (one can emphasize either the "natural" erosion or the many regulatory changes). Many have become very profitable financial intermediaries competing well in both the markets where they once had monopoly privileges and in markets

which were once closed to them. North American broadcasting and communications corporations are examples of firms whose monopoly privileges were lost more suddenly, via legislation (though one can make much of the underlying technological reasons), many of which are surviving, even thriving, in a new competitive environment.

The experiences of companies accommodating to lost monopoly power and profits show us that restructuring of a corporation to accommodate a new environment is likely to concentrate first on reducing labour inputs, and even more specifically on reducing the number of employees hired on long contracts. Fewer "regular" employees means fewer in-house workers to be trained. More to the point, the numbers of industrial trainers in these firms is often reduced in greater proportion than numbers of other employees. Some training is simply reassessed as expendable, some can be contracted out more economically, and some can be postponed. For some training organizations, most notably the leaner single-purpose types, this will provide opportunities on a vast scale.

• ***restructuring of a corporation to accommodate a new environment is likely to concentrate first on reducing labour inputs; the numbers of industrial trainers in these firms is often reduced in greater proportion than numbers of other employees***

On the other hand, few assurances can be offered to the trainers, program planners or training departments in large multi-purpose training organizations who are accustomed to the comfortable supposition that next year will be like this year, but just a little bit different. The training required this year will almost certainly not be the training required next year. Nor will it serve the same product specifications, or even be provided in the same place by the same people. Restructuring calls for the critical questioning of why things are arranged as they are. So far as training is concerned, what activity sets can be taken apart and reassembled, which activities eliminated, which done elsewhere for less?

To improve efficiency at any point is to get more benefits with no increase in costs, or to get no decrease in benefits at some reduction in costs. This is the intellectual basis of restructuring. Once we finish appreciating the irony that industrial training often experiences the trauma of restructuring early and severely, it is not difficult to accept restructuring as the frame of reference for all industrial training. So, one degree removed, the analysis of organizational costs and benefits, of every large and small choice, or of every policy, strategy and tactic, is the rationale for planning and evaluating industrial training.

No very convincing logic can be offered to support the view that cuts in spending on industrial training *made in the interest of efficiency* ought to be countered by more government spending for such training. Moreover, in most of the APEC economies, especially in the long-industrialized states, increasing concern is being directed at the high levels of government spending, now seen as a national competitive disadvantage. In spite of this, it is not uncommon for special interest groups in a single economy to promote competitive advantage in an industry by encouraging government subsidy of industrial training strategically, i.e., very selectively.

• ***no very convincing logic can be offered to support the view that cuts in spending on industrial training made in the interest of efficiency ought to be countered by more government spending for such training***

In one economy or another, a larger share of the growing airline industry might become an economic objective of the government, subsidy of the industry's costs an elected strategy, and government-provided or funded training of mechanics a tactic of

choice. The internal political costs of the discrimination needed to prevent the financial costs from being a significant fiscal issue will be great. The economic consequences of making it part of a more general policy of subsidy will almost certainly constitute a serious competitive disadvantage.

There is today, in many economies, a greater popular awareness of financial choices and consequences than ever before. This, along with more critical appreciation of the competitive disadvantages of high taxes, contributes to more severe budget constraints. Government budgets are still the products of politics, and, whatever the role of bureaucrats in the process, the total budget constraint, and the major components of its "structure," are the work of politicians. But never before have politicians had to bear such critical scrutiny of budgetary behaviour.

One interesting element of the new economic order is that, as managers serve the interests of stock holders, and firms maximize their contribution to customer (and ultimately consumer) satisfaction, the customers are often foreigners. Moreover, stock holders and creditors may constitute an international community. It is ever more difficult to assert with much conviction the nationalistic objectives that were familiar strategies available to earlier generations of politicians and were often manifested as secondary corporate goals. For example, autarky may have long been both a respectable and feasible policy objective of Japanese governments, one that could formally or informally influence corporate behaviour. It is difficult to suppose it can be a source of secondary objectives for Toyota Corporation today, or be seen by such a company as an important constraint working on company policy, strategy or tactics.

An international corporation is best advised to work for production efficiencies in its plants world-wide, and for practices that support both worker efficiency in its installations and the marketing of its products everywhere. If the corporation can afford some secondary objectives or policy constraints, these should be limited to strategies for promoting currency stability internationally so that its foreign holdings can be transferred, with minimal costs, among countries offering new investment possibilities. If the corporation has no faith in the will of politicians to protect the value of their respective national currencies, another suitable objective for the corporation might be the support of better markets for financial futures. Scope for serving autarky or other national objectives is minimal.

A good example of the constraints imposed on politicians by the new economic order is Mexico, particularly as it copes with the current financial crisis. In Mexico City, people are very conscious of its newly acquired status as a great financial market. Those engaged today in modest entrepreneurial and white-collar employment speak with considerable sophistication about the choices that Mexico is making between investment and consumption, public and private. There is considerable preoccupation with the effects of government policy on economic growth and on competitive advantages and disadvantages. Interestingly, the emphasis on business information and finance in television news and the newspapers in Mexico is markedly greater than in Canada and the United States.

In Mexico, growth in technical and other higher education is virtually all in the private sector, notable for the near absence of government aid. Criticism of the government policy seems to be minimal. In fact, such criticism is muted even among the faculty and administrators of the private-sector institutions. Those who would have the governments subsidize private institutions or their students do not make the case on grounds of efficiency, and little is made of the investment benefits of public spending on the expansion of higher and technical education. There is, however, great enthusiasm for higher education as a sound private investment.

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Most of the very prestigious institutions at the university level in Southeast Asia are public, and selective. In Singapore, Hong Kong and Kuala Lumpur the competition for places in the most prestigious institutions begins early in a child's life and grows in intensity. Such keen competition suggests that the number of places does not grow as rapidly as do the classes of people with the ambition and means to attend. Private institutions are taking up an increasing part of expanding enrolments.

Singapore and Hong Kong are testimonials to the growth potential of free enterprise, relatively low taxes and access to an expanding market for exports. But in other cities too, throughout the region, there is evidence of growing prosperity dependent upon mainly private sector investment and the expansion of export industries, an expansion abetted by freer access to growing markets abroad. This is the part of the APEC world where the fastest expansion of the airline industry will occur, and it is not likely that most of the mechanics to service those planes will be trained in government sponsored programs. The employers of these mechanics will be competing intensely for the profits that accompany a larger share of a growing industry, and it seems likely that, over time, more and more of them will be trained the way the most efficient one of them does it.

• the employers of aircraft mechanics will be competing intensely for the profits that accompany a larger share of the growing airline industry; over time, more and more of their training will be carried out the way the most efficient one of them does it

2.0 EXEMPLARY MODELS

Exemplary Training Models in Industrial Technology describes a variety of approaches to the business of industrial training. Readers may be impressed by the range of tactics and strategies depicted. Although coverage is far from complete, there is no better, more current or more complete survey of similar models at this time. However, the value of the book lies not simply with what it contains, but also with what is absent and what it encourages, directly or indirectly, the reader to consider. This includes comparisons and costs.

The critic (by implication an expert) will find opportunity to praise, deplore, rank and compare. He or she can make the case that some of the training models described in *Exemplary Training Models in Industrial Technology*, or at least those with similar or identical training objectives, are better than others. Of more interest, it is obvious, even to the would-be critic who boasts only some familiarity with the field of industrial training, that projects purporting to be training workers for the same industrial purposes operate under very different policies, adhere to different strategies, and

employ different tactics. While it's true that these training programs are in the same industry, they are very definitely not in the same business. And, although one can make a good case for *not* comparing these programs, or for pointing out that in many ways they are not comparable, comparisons may be worthwhile, even critical, to anyone considering investing in one or the other.

To the reader who observes the complex world of industrial training from the point of view of macro economics and public finance, an obvious criticism of *Exemplary Training Models in Industrial Technology* is that the models are not assigned output-unit costs. The criticism is of little weight, however. It would be a questionable undertaking to produce unit prices for most of these programs, for which neither all the inputs nor outputs have market determined values. Even if that were done, it would be absurd to suppose the same methodology had been applied to all programs. In any event, it is not to be supposed that unit costs suitable to make comparisons across programs could be produced.

The descriptions of the programs presented in *Exemplary Training Models in Industrial Technology* may impress the reader more for the variations in challenges faced economy by economy, or for the homogeneity of intentions and goals demonstrated by industrial training operations across these nations. The training programs typically serve single industries or a specific range of industrial activity, and at the same time claim to enhance the economic value of the trainees and the competitiveness of their employers. In many cases, a project in one economy has near counterparts in another economy. That is, in other countries there are projects to train workers to the same qualifications, but the operations are typically conducted according to different policies, strategies and tactics. Policies, then, seem to be the main determinants of the differences among training programs, especially across national boundaries.

There could scarcely be a better example of this than the programs in Exemplary Training Models in Industrial Technology that deal with the training of aircraft mechanics and engineers. Aircraft mechanics in one country service the very same planes as do mechanics in other countries. They abide by identical or very similar codified standards, economy to economy. According to pilots and the airline companies that hire them, the quality and costs of service, maintenance and routine repairs among the airports in APEC economies are notable for homogeneity.[2] Moreover, the significant differences that do appear tend to be short-lived. We are left then with a very interesting observation. Mechanics, apparently, are trained at very different costs in the different programs, and different unit costs for a homogeneous product, such as a trained mechanic with specified credentials, is prima facie evidence of different cost-benefit ratios.[3]

2. An informal survey of eleven airline captains or first officers, a larger number of airline managerial personnel, as well as a few mechanics who had worked in two or more economies was taken, and, although entertaining exceptions were recalled, literally all said that homogeneity was the outstanding characteristic associated with training aircraft mechanics.

3. The absence of cost data be what it may, cost variations, and differences in concern for costs are quite visible, and acknowledged.

3.0 THE AIRCRAFT MECHANIC

The aircraft mechanic, or the international population of these mechanics, is a fine example of the ability of modern industry, with or without the help of governments, educational establishments and agencies of various sorts, to mobilize the qualified workers they want, when they want them. As qualified, skilled workers, indeed as certified skilled workers, persons whose qualifications are recognized in law, an adequate supply of them is essential to their industry. An assurance that there will be specified increases in their numbers is necessary to any plans for, or expectations of, growth in the airline industry.[4]

The Aircraft Maintenance Technician Training Program, of Maktab Teknik Sultan Saiful Rijal, in the Sultanate of Brunei (see Hatton, p. 35), trains mechanics for the Royal Brunei Air Force, and for the Royal Brunei Airlines. As with many training programs, close examination suggests that what is referred to as one program is in fact better described as two or several. This training program is an operation in which the presence and role of foreigners serves the long-run objective of increased participation of Bruneians in the training of mechanics as well as greater participation of Bruneians in the aircraft maintenance industry. The training program is modest in scale, but is recognizable as a modern facility preparing trainees to do the same things to the same aircraft that they would be preparing to do were they training in Hong Kong or Toronto.

Another operation that is modest in scale is the Commercial Aircraft Maintenance and Repair Program of Delaware County Community College, in Philadelphia, Pennsylvania (see Hatton, p. 186). Delaware County Community College, itself, is a large American community college. Its many activities include "... a variety of joint training projects, within the U.S., in Latin America and overseas, often working in partnership with other training operations. This particular partnership activity [the aircraft maintenance training program] involved two U.S. Community colleges and a regional airline company ..." (see Hatton, p.186). The program, on closer examination, turns out to be remarkable for the range of interests served, i.e. the interests of the colleges, the regional airline, and an aircraft manufacturer. The program functions are just as remarkable for singularity of purpose, the serving of the airline's mechanical training needs (including some cross-cultural experiences for the trainees).

The training of mechanics in the Delaware program is a product for export. The resources of the college are used for this program when they might otherwise be idle or less profitably employed, and a secondary employment opportunity is created for the instructors. The college receives revenues derived from the use of very expensive capital equipment and space that might otherwise be idle or nearly so, the airline is making a comparably opportunistic purchase of training services, and the manufac-

4. There is variation in the uses of the terms mechanic and engineer. In a few places the terms are used almost interchangeably. However, where there is a distinction, it is usually one of "signing power." Many or most procedures must be "signed for" by a certified engineer. That person is not ordinarily a graduate engineer, but a senior mechanic who has acquired further certification.

turer is making good use of a marketing opportunity. The efficiency justification of the operation is convincingly apparent.

The aircraft engineer training program offered by the Workers Institute of Technology (WIT) in Malaysia (see Hatton, p. 105) is only one of its many engineering and technical diploma courses. Important to note within the context of this essay is that WIT's institutional objectives derive from the fact that the college was founded as and operates within the context of a "workers" school, complete with funding from national and international unions. This affects the organization and delivery of training as the institute entertains multiple goals.

A helpful presentation of the constraints working on industrial trainers, and trainers of aircraft engineers in particular, in an economy where centralized planning of the economy includes projecting the demand and supply of aircraft engineers, is found in Mr. Ng Fook Meng's dissertation, *Training and Development of Licensed Aircraft Engineers in Malaysia Airlines: A Strategic Plan 1992 - 2000.* The training of aircraft engineers in this context is not simply to produce credentialed workers. It is to produce Malaysian engineers - who will replace higher paid foreign engineers working in Malaysia - in order to save money (for the national carrier).

• complex policy objectives are not amenable to cost-benefit analysis

This is a complex policy objective, not very amenable to cost-benefit analysis. And it may well be a fine example of a policy objective, a policy and a mode of policy making that is passing from style. It deserves very close attention and analysis by anybody interested in the changing world of economic policy. These are the points to be noted. A training program that produces many Malaysian engineers, well trained and certified, will not necessarily result in the replacement of foreign engineers in the country. Even if it does that, the result might not save money for the national airline. What we have is a single policy decision attempting to deal simultaneously with decisions that must be made at several points in time at several levels of policy authority. Well trained Malaysian engineers or mechanics may have better things to do than to replace foreign mechanics or engineers in Malaysia. The national carrier may not always be a national carrier, and it may not always be in its financial interest to hire the well trained Malaysian mechanics.

Industrial training is subject to social and political intervention or control, as is any aspect or type of education. As it becomes politicized, the objectives served, in addition to specific training, can be as numerous as the interest groups. The Aeronautics - Structural and Electrical Assembly Program, of the National Institute of Aeronautics, at College Edouard-Montpetit in St. Hubert, Canada, provides an additional perspective on this phenomenon (see Hatton, p. 42).

The area surrounding Montreal's Mirabel Airport includes the greatest concentration of the aeronautical industry in Canada. More than " ... 150 companies hire 32,500 workers and sales (totalled) 4.5 billion dollars (Cdn.) in 1992" (Hatton, p. 42). In an effort to maximize local employment opportunity from the growing demand for skilled workers, " ... Quebec's National Institute of Aeronautics (NIA), a subsidiary of College Edouard-Montpetit, the largest French community college in Canada, [pro-

posed] to establish a custom-designed on-site training program. ... [it] identified two specific work categories that accounted for more than 60% of [a large plant's] work force: structural assembly workers and electrical assembly workers." The resulting program started in March, 1989, is fourteen weeks in duration and encompasses " ... approximately 490 total hours of instruction and shop floor work."

The multiple objectives of the program are described in part by the recruitment and selection policy. "Participants ... were selected from among unemployed workers receiving unemployment benefits and persons holding part-time, low paying jobs. ... more than 90% of all hired employees live within a 20 kilometre radius of the plant. Although ... a traditionally male dominated sector of industry, 15% of all recruited participants were women" (Hatton, p. 44). Between March, 1989 and the end of 1991, 218 students were trained. The Canadian Government's contributions were "in the order of $2 M (Cdn.) ... ." Whatever the costs to other funding sources, some $9,130, $650 per week, or $18.50 per hour of instruction was paid by the Canadian Government for each student. When compared with the program at Delaware Community College, it is clear where this program stands on the single versus multiple objective continuum.

These examples adequately demonstrate the variation over a range of simplicity-complexity for the objectives that industrial training programs serve. Two additional training models, though not reported in *Exemplary Models of Training in Industrial Technology*, will develop that continuum even further. In Thailand, the military controls aviation. There are no private planes, no private schools for pilots or mechanics, and no private charter-flight operators. To be trained as a mechanic is to be trained as a military person. The simple aspect of this policy is that it serves one client. In this sense it is simpler to conceptualize than the program at Delaware County Community College. But the training functions are not simple, and as industrial training they defy cost-benefit analysis. The training of these aircraft mechanics is only incidentally industrial training.

In Hong Kong, the Hong Kong Aviation Engineering Company (HAECO) trains mechanics under a policy objective at least as singular as that at Delaware County Community College. Cathay Pacific controls HAECO, and HAECO managers say that they perform much as a department of Cathay. HAECO recruits trainees from Hong Kong secondary school graduates, gives them two weeks of class room training, then begins a work-place and class-room on-the-job training program of almost two years in duration. The outcome of the performance objectives and budget constraint is simple: HAECO trains mechanics. It claims no interest in whether its trainees are Cantonese or permanent residents of Hong Kong from somewhere else, and no responsibility for instilling military or civil virtues, or for reducing unemployment and poverty among any class. This budget constraint discipline could be cast in cost-benefit terminology.

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4.0 DEVELOPMENT AND GOVERNMENT EXPENDITURES

We have made much in these pages of new attitudes and conditions, referring to the events since the most recent contraction in the business cycle, the recession of the early 1990s. But these are only the newest consequences of reorganizing the world according to some "new" ideas that have become popular or generally accepted perceptions across much of the world in the years since 1945. They are notions about government expenditure, public policy and "development." To appreciate them, we must give the modern, secular conception of development its due.

• when we speak and write about development, we are referring to an economic phenomenon, even if we are about to deal with the social, political or biological aspects of it

No concept has captivated the attention of pragmatically oriented social scientists in the past fifty years more completely than that of "development." Today, when we speak and write about development, we are referring to an economic phenomenon, even if we are about to deal with the social, political or biological aspects of it. The unit of analysis we are concerned with is a nation state, unless we stipulate otherwise. The usual measure is product (output or income) per worker, or per capita. The most familiar form of this measure is gross national product or gross domestic product per worker or per capita.

The conventions we adhere to regarding measurement imply a great deal, or, more correctly, subsume many other conventions and assumptions. Some of these have become so well established over the last fifty years it is only with difficulty we can recall how new most of them are. National accounting, the art and science behind the data on economic performance of nations, was practised effectively by only a very few nations fifty years ago. The emphasis on per capita measures as the indexes of development, and progress, when taken for granted, obscures an important happening in our history. Neither development (as we measure it) nor progress (however understood or measured) has always been an important end of good government. That it is today an important end to be served, perhaps the end of first rank, is either a great educational accomplishment or a peculiarity of our time.

Nation States have become universally dependent upon national accounts in all our approaches to planning development. Even those scholars and politicians who argue against planning use these planning tools in their arguments. Which is to say that what pass for arguments against planning are most often arguments for decentralizing planning authority, from national or federal governments to provincial or local governments, from governments to firms or individuals, and even from firms to individuals. Virtually every nation state in the world purports to do national accounting today. If a nation state lacks the resources to produce creditable accounts, the development assistance it can be most certain to be forthcoming from developed nations or international agencies is help in producing national accounts.

Nation states are the great tax and fact collectors. We may assume that they collect the facts so that they may collect the taxes better. It is as fact collectors, however, that they have conditioned us to conceptualize our collective prosperity and progress using the nation as a factual frame of reference. Even the ardent individualists among us do it. And for good reason. Among the most important political-philosophical ques-

tions are those pertaining to how to apportion wealth between government and taxpayers, and among the categories of government expenditure.

In 1883, a German civil servant and economist, Adolph Wagner, made a sociological observation on the trend of the apportioning of revenues between public and private expenditure. He simply noted that the trend in industrializing states (his term for 19th century development) favoured the state, and boded likely to continue to do that. This became "Wagner's Law of Rising Government Expenditure."[5] He never used the term, and there is no evidence that he intended to be offering a normative rule or a law of nature. He may have meant little more than something to the effect that the germ theory, telegraph lines, telephone systems and railroad building evoked good arguments for increasing the functions of the state.

In the final decade of the life of John Maynard Keynes (he was born the year Wagner offered his generalization, and died in 1946), he offered some arguments for increased government expenditure as good strategy and tactics to counter the malaise he saw in Britain of the 1920s and the Great Depression of the 1930s, especially as it manifested itself in North America. He never offered any normative argument for high or increasing government expenditure either, though many people think he did.

The historical fact is that the great economists of the 18th and 19th century, who had keen things to say about making men freer from government constraints on trade and the uses of land, labour and capital, had little to say about how much of national wealth and income should become government wealth and revenue. In 1892, C.F. Bastable, who, as a good economist of his time, would have acknowledged that debt financing of capital equipment did not necessarily reduce the net worth of a person, a firm, or a nation state, offered only very cautious endorsement of public borrowing. He made it clear that the financing of "the Prussian railways, or even of the English telegraphs," by debt was sound public management. About investment in what we call human resources, Bastable (1937, p. 670) wrote:

> A loan for the purpose of extending education, or for improving the housing of the workers, ... may ... so increase the income of the community as to make the tax receipts greater, without any increase either in rates or in rigor of collection. Regarded in the abstract such a proceeding seems defensible; the real objections to it arise from the difficulty of application. The results of expenditure of the kind are hard to trace or measure, and any statement respecting them must rest in a great degree of conjecture ... Prudence seems accordingly to suggest that borrowing should hardly ever be adopted except for strictly economic expenditure ...

5. A good treatment of Wagner's Law, in English, is found in Musgrave's Fiscal Systems, p. 73-75.

Thirty years later, in 1922, the English economist Hugh Dalton offered this model for perfection in the pattern and quantity of public expenditure:

> A public authority, not being a person except in a legal sense, cannot estimate the many utilities of its varied expenditures as an individual can. But the general principle on which statesmen should attempt to act is the same. The marginal utility to the community of all forms of public expenditure should be equal, and the distribution of a given total of expenditure between different objects thus theoretically determined.
>
> Public expenditures in every direction should be carried just so far, that the advantage to the community of a further small increase in any direction is just counterbalanced by the disadvantages of a corresponding small increase in taxation or in receipts from any other source of public income

In this usage, expenditure connotes investment no less than consumption. Dalton's was one of the first statements, and probably the most complete offered to that time, of the application of marginal utility and equilibrium concepts to public spending and investment. A good case can be made that until we had a conceptualization such as Dalton's, cost-benefit analyses would have been without motivation or meaning.

No basic principle of economics separates Dalton and Bastable. They do not report markedly different facts about the world. Their statements are separated by thirty years and different attitudes. Bastable would not regard as investment something that is not substantial, that cannot be kicked. He uses "strictly economic" as a synonym for the tangible capital goods that produce measurable benefits. Only these can justify public borrowing. And he holds public indebtedness to a higher standard of justification than private borrowing. Our current propensity to borrow, even for operating expenditures in the public sector, he would find anathema. Hence, he would not accept cost-benefit rationalizations of expenditures for the development of human resources.

By contrast, Dalton articulated a model of public expenditure and investment that would make little or no distinction between public and private benefits for the rationalization of costs, public and private. He does not hold the rationalization of public debt to a higher standard than private debt. He does not preclude expenditure for non-tangible benefits or even investment in non-tangible assets. He was, in 1922, attitudinally prepared for cost-benefit analysis of public projects, even those purporting to be investments in the development of human resources. However progressive his attitude for 1922, he was not advocating relaxing of severe rationalization of expenditures, much less borrowing. He would have us be free of unreasonable fear of public debt, but not of the discipline that requires critical comparison of each component of expenditure to its associated benefits, i.e., of cost-benefit analysis.

As good a case in logic can be made for Bastable's statement as for Dalton's. And, of course, as good a case is to be made for the gold standard as against it. But logical

arguments are not simply good or bad, right or wrong, weak or strong. They are also modern or old fashioned. Fashion does not always move in one direction, if it is directional at all. To put cost-benefit analysis into logical and historical perspective, one does well to read and ponder the paragraphs above by Dalton. To appreciate the attitudes or "fashions" in our thinking about spending, public spending especially, one ought to remember Bastable's caveat (1937, p. 670): "the results (of expenditures on education and workers' housing) ... are hard to trace and measure, and any statement respecting them must rest in a great degree of conjecture ... Prudence seems accordingly to suggest that borrowing should hardly ever be adopted except for strictly economic expenditure..."

5.0 BUSINESS SENSE AND COMMON SENSE

All of this might bring to mind some truisms of good management. After all, most logic of means and ends applies both at the level of the firm and the state (so says Hugh Dalton). Let us look at one of the most familiar, the Total Quality Management tenet from Deming (1994) to the effect that managers should always be looking both "upstream and downstream." Downstream TQM demands delivering the best possible outputs to the next stage of production or to consumers (customers at any rate). Upstream TQM calls for the exercise of choice and influence to get ever better inputs, whether from the earlier stage of production or from an outside supplier.

This is the heart of the promise for dynamism in TQM. Each upstream improvement or economy that a unit can bring about offers new promise for improving outputs from the unit to the next stage of production or to customers.

Essential to TQM is the questioning of habits and loyalties: habits of accepting inputs as they have been, loyalties to suppliers not in sympathy with continuing improvement, of their own outputs or their customer's inputs. (The logic of this parallels that of questioning monopoly privileges.) It is a logical and progressive step from TQM to just-in-time production processes. In the spirit of TQM, managers of earlier production stages, or managers of outside suppliers, care about logistics (because their customers or next-stage production managers do). An element of quality in goods moved downstream, or to a customer, is when and where they are delivered.

Logistic efficiency is a function of delivery and storage costs, and of dependability of on-time availability. An efficient logistic state for a production process is characterized by equilibrium between the internal costs of storage and re-deployment (for a given level of assurance of availability), and the internal benefits of maintaining that level of certainty of availability. As the logistic agencies become more and more efficient, we expect more production processes to have ever more of their inputs delivered just when needed.

Whether or not we resort to TQM to get across the canons of good management of training, it is logical to maintain that every production process, every firm and

industry, looks to a supplier of qualified manpower for one of its classes of inputs. That supplier may be a personnel office (or office of human resources) with or without training programs, company training programs or departments not subordinate to a personnel office, an educational institution or system, or a defined population somewhere. The managers who use qualified manpower, quite logically, use their powers of choice and influence to get the best qualified workers they can for a given cost.

In some settings their powers of choice and influence are of considerable effect. In other settings they likely are of little or no effect. For example, in every economy with a pretty good approximation of universal schooling to some level, it is a familiar complaint of employers that the products of that level of education are not what they could or ought to be. Quite correctly, each of them claims that, ceteris paribus, his business or his firm would operate more profitably could they have better educated or better trained employees than they get. However, had their domestic competitors also recruited better employees at the prevailing wage rates, many of them would do little or no better. Whether an entire industry or the economy as a whole would do better, if the average education and training quality was a little higher ... must rest in a great deal of conjecture. Their desire for better inputs notwithstanding, employers prosper in proportion to how well they use the workers that can be had at the prevailing wage rates. The same may be said for other inputs, of course.

The managerial and entrepreneurial skills required to make profitable use of the qualities of labour available is akin to the skills related to production processes using just-in-time delivery of inputs and intermediate products. The manager who employs a worker who knows now, or will learn on his own, what he will need to know a year and a half from now, has probably employed a person who will command a relatively high wage for the job he or she is doing today. We may say that the employer will be paying for skills and knowledge for a year and a half before they are needed.

• the employer who hires typical school leavers this year, at the prevailing wage rates for such workers, and then, with or without the help of other agencies, sees to it that for years to come those workers know what they need to know just before they need to, enjoys an important strategic advantage

The employer who hires typical school leavers (or typical workers at whatever experience level) this year, at the prevailing wage rates for such workers, and then, with or without the help of other agencies, sees to it that for years to come those workers know what they need to know just before they need to, enjoys an important strategic advantage. The development of the related skills among managers and trainers is an aspect of restructuring that can neutralize the lower-wage advantages of competitors.

To emphasize skills and knowledge as the inputs supplied just-in- time hardly qualifies as a new idea, even if it were being done for the first time. It is raised here as the logical limit of cost-benefit justification. Not one iota of inputs is committed to production or to training that will not be used, and used to greater benefit than employed producing something else or training for something else.

6.0 SINGULARITY OF PURPOSE & COST-BENEFIT ANALYSIS

Burkhead and Miner (1972, p. 206) describe the essence of the cost-benefit concept perhaps in terms a bit more directly relevant to industrial training than do Prest and Turvey.

> Benefit-cost analysis is a technique for assessing the economic utility of a public investment project. The technique can be used to indicate whether a specific expenditure should be undertaken. It can also be used to determine the appropriate scale of investment and thus the optimum size of a specific investment project...

Cost-benefit analysis is a variant of investment analysis. Like all investment analysis, it deals with some tangible and quantifiable variables and values, rigorous or seemingly rigorous logic, and with more hypothetical variables and values, and some conjecture. Intuitively, when the business at hand is analysis, we want to avoid the hypothetical and conjectural.

The most that can be hoped from cost-benefit studies is that they help us design systems of expenditure - for application where market-valued costs or benefits are not to be had - that are guided by the definition of efficient government expenditure as described by Dalton. It is in the nature of government expenditures that the estimation of costs and benefits of concern be done iteratively, and it requires uncommon discipline to guide these estimations. The question may be raised, is the rationalization of industrial training comparable in difficulty to the achievement of efficiency in government expenditure?

The answer can be,"of course not." When the training is conducted as ventures disciplined by relatively easily reckoned substitutes for market costs, or by alternative-use costs and benefits, cost-benefit ratios are the natural products of financial accounting. Such would seem to be the case of training mechanics at Delaware Community College. When they are conducted by an internal department of a cost-conscious corporation, such as HAECO in Hong Kong, the training of mechanics can be an activity subjected to cost and benefit constraints. In this context cost-benefit analysis takes the form of the less arcane, more familiar practices of modern cost-accounting. But when industrial training serves objectives such as the reduction of unemployment in specified areas, the training and socialization of military personnel, the directed evolution of the character of a work-force, and the prestige of a national airline, the disciplining of expenditures and the estimation of the ratio of benefit values to their associated costs is as difficult as the achievement of efficiency in government expenditures. Indeed, it is an aspect of such efficiency.

The usual challenge of cost-benefit analysis is the evaluation of actual or proposed government projects. Characteristically, most of the benefits are not amenable to reckoning by money or any single index, often even the costs are not readily given cardinal values. The opportunity for subjectivity and conjecture creates at least the appearance of "political rationalization," to which the appropriate response must be,

grand investments are political decisions always, and rationalization is the means to rational politics.

One need only contemplate for a while the political, engineering and financial challenges of "improving a river," or building a new airport, to appreciate that, though the concept of cost-benefit analysis is "common-sense," initiating and completing a cost-benefit analysis of a great new-departure or grand project requires extraordinary determination, uncommon talent and infinite tenacity. To produce an approximation of the net benefit to generations of people from the "improvement" of the Saint Lawrence or Yangtze Rivers, or the creation of a new island to facilitate air traffic in Hong Kong is, unavoidably, the subject matter of cost-benefit analysis. However, few engineers or economists would venture to do benefit-cost studies for these monumental projects were they not presented first with the policy, the grand political decision, that there shall be a project for the improvement of a river or the provision of a new airport for Tokyo or Hong Kong, and with the complementary decisions giving the project a budget constraint and a schedule of expected accomplishments.

Competent professionals then can attempt to estimate the relative net benefits following upon such project-related choices as: three dam-sites vs five; the sacrifice of crop-land for recreational areas; and the trade-off of navigational improvement for flood-control. Such decisions, and the "middle-scale" projects they attend to, are the common ground of engineers and economists. The economist may or may not have an engineer's mastery of options available regarding techniques and inputs; and the engineer may or may not have an economist's understanding of efficiency and its dependence upon revealed preferences; but it is the economist's keener interests in ends and means, categories of benefits and costs, utility maximization, and realization of costs and benefits as aspects of total utility that make the involvement of economists in cost-benefit efforts inevitable.

It appears that the best way to deal with the truly challenging problems of evaluation is to minimize their number. Often that minimization is achieved by organizational change. Is it not in the spirit of our times to evaluate as many things as possible via market pricing and recognized substitutes such as internal cost-accounting? Rather than do cost-benefit studies of complex programs that include the training of aircraft mechanics, why not organize the related training activities in single-objective programs?

One of the things that trainers of airline mechanics are fond of pointing out to interested outsiders is that the modern airliner can only be known through its components, because it is a "componentized" phenomenon. They go on to explain that just as the planes are componentized, so is the training of those who maintain and repair them. Some mechanics can work on more components than others. Some can assume more signing authority than others. As new components come on line, whether as minor changes to old models or as whole new airplanes, the challenge is the same. By componentizing the objectives, training and otherwise, we can determine the costs.

Let us look at this same issue from the other side. One cannot follow the business

news in any APEC economy for long without being reminded of the rapid growth of the airline industry and the expected continuation and acceleration of this growth, especially in Southeast Asia. Some predictions are for ten percent average annual growth for five, seven, ten years to come. Some for doubling of the scale of the industry by 2003, 2005, 2008. The number of people flying to, from and within Southeast Asia will increase markedly and quickly, and these rates and coefficients are the products of investment analyses that follow from that.

It is certain that more people in that part of the world (and to varying degrees, the world over) will earn their living in the airline business. Among them will be a larger number of mechanics. They will be trained to a high level of competency, and to very uniform standards. Investors will look for promising opportunities, with little in the way of the interests of one economy or another on their minds. Politicians will have national interests in mind, but those will include attracting more international capital, and encouraging more jobs, mechanics included, associated with the growth of the airline industry. The very concept of "national carrier" may erode, and more certainly the motivation for emphasizing the non-economic objectives of airlines will diminish. Most importantly for most economies, the efficiencies demanded by competition will be intolerant of industrial training programs not characterized by singularity of purpose.

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The glamour and excitement of the business of maintaining and repairing airplanes, whatever it once may have been, has been fading for a long time. So has the national prestige associated with a national carrier, though perhaps more recently. Little is left to the military-strategic rationalizations of airline regulation. The rationales for monopoly in the industry get more strained with the passing of time. With the passing of monopoly will pass also the temptation to use airlines, especially airline employment, as the vehicle to serve a variety of social and political objectives. The business of the airlines is just business, there are fewer and fewer reasons to complicate the industrial training related to them with unrelated objectives.

The world seems to be full of industrial training programs that labour under policies peculiar to the politics of their time and place. The different policies beget different strategies and tactics. But the emphasis upon competitiveness, and competitive advantage that characterizes our time, appears to be working to minimize the imposition of policies not necessary to the conduct of business. That same competition will have training programs looking ever more closely at one another to see whose strategies and tactics, techniques even, are more efficient.

In the business of training mechanics to work for air carriers, competition will encourage, perhaps dictate, that all programs become more like the most efficient in organization and practice. There is the suggestion in all this that large training programs will become more like HAECO's, and smaller ones more like the program at Delaware County Community College. The rationale for reorganizing our economic affairs in the direction of simplicity of objectives is overwhelming. Is there anybody among us so talented that he can estimate the cost-benefit ratios of programs that would inculcate cultural values, change the national character of the work force, develop military capacity,

• in the business of training, competition will encourage, perhaps dictate, that all programs become more like the most efficient in organization and practice

impart civil virtues, reduce unemployment and train aircraft mechanics at the same time?

It will be challenge enough to train all those mechanics the expanding airline industry will need ... just when needed. Of course, there is the matter too of training the flight attendants, reservation clerks, pilots, traffic controllers and managers. If we emphasize simplicity in the organization of our work, we may well have enough of them available when and where we need them.

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